JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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EDITORIAL NOTES—GAS, &c.

London Gas Coal Contracts.

THE London Gas Companies whose demands are the largest have got to close quarters with the coal owners; and it is a stubborn tussle that is going on between the contending parties. The Companies are showing the Durham owners that, while they possess the coal and can stand as firm as they please upon what they "consider" to be, as one mild-mannered reporter puts it, "the true market value of their "coal," gas coal buyers are quite strong enough to make things uncomfortable for any particular district when the market value ascends to what they, on their part, consider to be unrighteous heights. If they suspect "understand-"ings" between sellers for maintaining undue prices, reprisal may be warranted in order to bring things to their proper bearings, even with a little sacrifice, by diverting custom to other districts. It comes to this, that coal owners have boasted of their strength of purpose because they hold the coal that the gas undertakings want. But, on the other hand, the gas undertakings have the money to spend that the coal owners are desirous of handling; and the administrators of the gas undertakings can spend that money in any coal district that they like to choose. The two largest London Companies have been making considerable purchases in Yorkshire; and to the extent (see "Coal Trade "Reports" in this issue) that they and other undertakings have done so, and continue to do so, so much the worse for the Durham owners. The London Companies have not discontinued negotiations in Durham; but they are, so latest advices state, still refusing to give the prices quoted. The reports that come to hand from Durham remain vacillating in tone. The prices of 12s. to 12s. 6d. are mentioned for immediate sale; but 12s. 9d. is quoted for next month. The reports from Yorkshire have an exceedingly joyful note about them, owing to the large bulk of business that has been and is being settled, at about 2s. 6d. higher than last year's contract rates. Prices quoted are: For screened coal, 10s. to 10s. 6d. per ton; unscreened 8s. 6d. to 9s.; nuts, 8s. to 9s. The demand for nuts is stronger than ever. Nottinghamshire also seems now to be sharing with Yorkshire in the good business with gas-works, both near at hand and distantly situated.

A Suggestive Presidential Address—
The Work and Funds of the Institution.

IN 1901, Mr. Corbet Woodall was the President of the Southern District Association of Gas Engineers and Managers; and he then delivered an address which we, with the full consciousness that the judgment would be universally ratified, described as "brilliant." Last Thursday, Mr. Harold W. Woodall was installed in the same position that his father occupied six years before; and he also delivered an address to which the same descriptive characteristic may be truly ascribed. The address was alive with independence of thought, with initiative, and with the spirit of inquiry—right away from the opening remonstrance as to the inequalities under which the gas and electricity industries operate (to the detriment of the former) to the description of the Woodall-Duckham vertical retorts as constructed on the improved lines that patient inquiry and effort, and indomitable will, have produced. And not only in relation to the essay to attain, by the combination of known methods (a combination which was only to be ultimately realized by skilful and inventive adaptation), the never before successfully achieved ambition of many engineers—continuous carbonization, but in other departments of operation, the beaten track only suffices at Bournemouth so long as some easier or more productive route to an end cannot be found.

The Bournemouth Gas and Water Company, among other things, have successfully invited co-operative relations with their workmen by what is known as a "Suggestions "Box." The Council of the Institution of Gas Engineers will not fail to notice that this address of Mr. Woodall's is a veritable "Suggestions Box" for them and others, though there may be some disagreement with the propounder of the suggestions. The first one is not addressed to the Council of the Institution; but it concerns any two or three Gas Companies who may be affected by the clause which certain electricity supply companies have introduced into agreements which, in consideration of special terms, prohibit a consumer from using any other methods of lighting during his term of tenancy of the property concerned. It is believed that such agreements are *ultra vires*. Section 20 of the Act of 1882 distinctly specifies that, in the making of agreements for the supply of electricity, undertakers are not to show any "undue preference" to any local authority, company, or person; and besides this an agreement such as that to which the President calls attention overrides the liberty that the General Gas and Electric Lighting Acts confer upon the householder, of demanding a supply of either gas or electricity. It would be an easy matter for two or three companies to test the question as to the power of an electric light company to insert such a clause; and we hope, with the President, that this may be done at an early date.

Suggestions to the Council of the Institution, of lines of work along which they may devote their energies, fell thick and fast in the address. We all admit the necessity for the amendment of the Gas-Works Clauses Acts; but the question of attainment is the one for present consideration. In the Council's report last year, it was stated that the matter of obtaining an amendment of the Acts had been brought before them, and had been referred to the Parliamentary Committee for consideration and report; and in the circular appealing for contributions for the Special Purposes Fund (and which circular had such lamentable ill-success in its mission), allusion was again made to the desirability of the modification of general gas legislation. The Council have carried this matter as far perhaps as it is advisable to go at the present time. It has been rumoured (and we shall possibly have confirmation of this when the annual report of the Council is issued) that the Board of Trade have intimated very plainly that amendment of the Gas-Works Clauses Acts in one direction must be accompanied by amendment in other directions. The amount and nature of the revision that the Board would propose are unknown quantities; and it would be the height of folly for the Council to commit the gas industry in any way by taking a leap in the dark. The Gas-Works Clauses Acts—in effect though not in intention—affect Gas Companies more than gas-supplying municipal authorities. All come under the Acts; but in the case of the latter there is no watching authority to compel obedience to much of the general fundamental law. We are passing through a period when private enterprise is not regarded in the best light by the powers that be; and caution with a view to the protection of interests must be strictly observed. Another suggestion that the President made is that the Institution should refute, by obtaining the opinions of high and honoured authorities, the damaging statements of competitors as to the pernicious effects of the products of the combustion of gas on health, fabrics, leather, and decorations generally. We believe that the London Gas Companies are at present working in this direction, with the aid of experts; and it would be wasted energy and money for the Institution to also engage in this particular work. There was a considerable amount of evidence given on these matters before Lord Rayleigh's Committee; but something more conclusive is now being sought.

We are forced to disagree with the President as to the character of the work that should be undertaken by the

Gas Companies' Protection Association, and as to the absorption of the work of that body by the Institution. The Institution is a technical body; the Gas Companies' Protection Association in its aims is not, and there has always been care exercised to avoid any trespass on the ground occupied by the technical organizations. Furthermore, the Institution is a composite body; the Gas Companies' Protection Association has only membership drawn from privately owned undertakings. In many ways, the interests of municipal authorities and companies have common ground; but administratively and legislatively they are sometimes hostile. Therefore at times—but not always—the matters dealt with by the Association, if undertaken by the Institution, would not be consonant with the views of the municipal authorities whom a large proportion of the members serve. Let us instance the work done by the Association in opposing the Electricity Supply Bill, in assisting in pressing for protection to underground pipes against electrolysis, in opposing the granting of powers to municipal authorities for speculating in free electrical wiring and fittings, and in other ways. The Gas Companies' Protection Association must remain an independent entity, and not have its activities shackled, as they would be if governed by an Institution some of the members of which could not be loyal to their employing authorities and at the same time extend sympathy to part of the work carried on by the Association.

Research and pioneer work cannot be prosecuted without money; and mention has already been made of the ill-success of the appeal of the Council of the Institution to enable them to explore and to assist in clearing away obstruction. The President of the Southern Association holds that the Institution is now an "excellent organization;" and in an after-dinner speech on the same occasion, Mr. Corbet Woodall acknowledged that, in constitution, the Institution holds a commanding position for technical work in the gas industry, though, at the same time, he alluded to the investigation now being conjointly conducted by the London Gas Companies, and to the amplitude of their resources. However extensive the resources of the London Gas Companies (and the gas industry is beyond measure indebted to them for having put those resources to the best possible use in the past and in the present), there is one resource in which the Institution are superior, and that is the vast body of intellect represented by the hundreds of members, among whom are included all the chief professional men of the Metropolitan gas industry. Not so very long since we were constrained to express regret that the Institution should have been maimed at the outset of their attempt to commence operations on fallow ground. But a ray of hope burst through the gloomy aspect of affairs in this particular regard at the Southern meeting. A sanguine temperament has carried the President of the Association far in his special work, and it comes to the surface again when he says he does not apprehend any difficulty on the part of the Institution in securing funds. And what is of importance, Mr. Corbet Woodall corroborates. "If," he says, "the work undertaken by the Institution is "likely to be productive of good, there will be no lack of "funds to carry on the work. There is patriotism among, and "*camaraderie* enough between, the Gas Companies and the "Corporations of the country to cause them to join heartily "in any such work for the benefit of the whole industry." Mr. Woodall knows the industry thoroughly; and his position in it carries great influence. The President of the Institution (Mr. Charles Hunt) did not let the opportunity slip. He announced that the Council of the Institution have undertaken to investigate one subject, and that the important one of carbonization. This is confirmed by a paragraph which appears elsewhere. By this investigation, it is hoped, to bring to a focus what has been done, and what is being done; and by this means to do something towards raising the level of carbonization. Better work, with judicious handling, could not be undertaken by the chief technical body. The problems are many; and the vertical retort has led to their increase. The inquiry lies at the very root of gas manufacture; the important subject that the London Gas Companies are investigating is found at the end of gas utilization. Between the two extremes, there is much else to engage in the future the best talent the Institution can command. The determination of the Council should commend itself; it certainly undermines much of the criticism to which they were exposed not many months since. For these and other reasons, as we have said, the President of the Institution did well in taking advantage of his opportunity, by expressing the hope that the Special Purposes Fund of the Institution would soon receive an important contribution from the great Company of which Mr. Corbet Woodall is the respected Governor. And we would add from all gas companies and local authorities who have not yet subscribed.

These important matters were raised by the address delivered in the afternoon by the President of the Association; but they only formed a small part of the subject-matter. Sound views are held by him as to the relations between employers and employed; and many profitable lessons in this respect are to be gleaned at Bournemouth. He believes that eventually salvation will be found in profit-sharing; but meantime he and his Company are doing an excellent work, by affording educational facilities, in improving the intelligence of their men, by which means both men and Company must benefit. Experience has firmly planted the conviction in the President's mind that any encouragement extended to the men will receive their support. Greater consideration for foremen is also advocated; while recreation is not overlooked. Information of value is also given as to the road conveyance of materials by motor traction, and as to the coal and electric-driving arrangements at the Bournemouth Company's new works at Poole. There will be passing disappointment that more was not said respecting the process of continuous carbonization under the Woodall-Duckham system. A description of the setting as now, it is hoped, perfectly developed is included towards the end of the address; but there is still absence of results. We appreciate, as all engineers will do, the reticence of the President in publishing results. Until the process constituted of many parts was faultless in every one, reliable figures were impossible. There have been many mechanical difficulties to overcome; and much balancing of methods to be effected. Hence the length of the developing and probationary period. But from the setting as now described, we may look in the near future for accomplishment that it is hoped will be the realization of advance in the product of carbonization and in technical knowledge.

National Physical Laboratory at "Question Time."

THE unsatisfactory composition of the Committee recently appointed by the Treasury to inquire generally into the work performed at the National Physical Laboratory has already been referred to in the "JOURNAL" (see *ante*, p. 456). Since the date (Feb. 19) of our remarks, the spokesmen of the Treasury in the House of Commons have had quite a lively time in answering questions asked by members on both sides of the House as to the Laboratory and the Committee of Inquiry. The matter, as befits a scientific and technical question, has been kept clear of political partisanship both within and outside the House. In the Daily Press, "The "Times" and the "Tribune" have vigorously called for the reconstitution of the Committee of Inquiry. The Technical Press, too, is singularly unanimous in the same sense. The "Engineer" has dealt exhaustively with the question, on which, also, a contemporary whose views we regret are commonly at variance with ours—viz., the "Electrician"—is in thorough agreement with us.

Sir W. Evans Gordon opened the subject in the House of Commons with a brace of questions addressed to the Secretary to the Treasury. The first referred to the public discontent with the policy of the Executive Committee of the Laboratory, and to the undertaking by the institution of routine commercial testing, "in spite of the fact that all "the witnesses examined by the Treasury Committee of "1897 were, without exception, agreed that no such work "should be done by the Laboratory." The second question recited that the Laboratory was brought into existence for the express purpose of carrying on research work for the good of the community, and it was asked what steps were taken to prevent the undertaking of routine commercial testing curtailing the quantity and usefulness of the research work, and defeating the object for which the Laboratory was brought into existence. Mr. Runciman replied on behalf of the Treasury, on the 7th inst., that a Committee were considering the points raised, and that pending their report no statement could be made. Two questions asked by Mr. Nield drew, however, from Mr. Runciman on the same date answers which throw an interesting light on the appointment and scope of the Committee. The first question called attention to the fact that two of the five members of the Committee of Inquiry were also members

of the Executive Committee of the Laboratory whose policy was called in question; and the appointment of a Committee independent of the Laboratory was asked for. Mr. Runciman replied that the two members referred to "were nominated by the Royal Society to represent its views at the "invitation of the Treasury. The remaining members were "appointed directly by the Treasury."

The humour of this reply lies in the fact that it is the Royal Society which appoints a majority of the Executive Committee of the Laboratory, and that it is the policy pursued by that Committee and the staff controlled by it which is the subject of inquiry! Mr. Nield's second question was as to whether the Committee of Inquiry "had been instructed "to report whether it be to the public advantage that the "National Physical Laboratory should continue to compete "with private testing establishments." Mr. Runciman's reply was very interesting, as it stated the terms of reference to the Committee, from which it appears that what had hitherto been published was only a summary. The Committee, he informed the House, was appointed "to "inquire generally into the work now performed at the "National Physical Laboratory, with special reference to "(1) the character of the mechanical, physical, and chemical "tests undertaken there; (2) the possibility of their inter-"fering unduly with the business of other agencies; "(3) the desirability of publishing the results of all such "testing work; and to report whether, having regard to "the industrial interests of the country generally and to "those of private agencies, any change is desirable in the "scope of the work of the laboratory, and on what lines "any further development of its business should proceed." The sting lies in the tail. It is not for the Committee to curtail the business of the Laboratory, and so bring it within the bounds set for it at its inception, but instead to remove these obnoxious obstacles to its ambitious career, and so pave the way for further development. And two-fifths of the members of the Committee to which this whitewashing and facilitating charge is entrusted have, in their capacity as members of the Executive of the Laboratory, been responsible for the overstepping of bounds of which such legitimate complaint has been made in the past!

Several more questions have since been asked in the House as to the work and finances of the Laboratory and regarding the Treasury Committee; but as, in one case at least, the answer has been deferred until to-day, we may fitly postpone comment on them until next week.

Coal, "Coalite," Coke.

THREE degrees of comparison are here illustrated. If the fuel is for the domestic hearth, the common verdict will, we fear, continue to allot the superlative degree to coal; but if the fuel is for metallurgical use, the order will be reversed, and coke will inevitably rise to the superlative rank. In both cases, "Coalite," whatever its cost, origin, or nature, is almost certainly doomed to the comparative degree, or the position of mediocrity. Since we referred last week to the curious reticence of those engaged in exploiting "Coalite" as to the process by which it is manufactured, Dr. Grossmann has contributed to the "Manchester Guardian" a second article upon "Smokeless Fuel from Coal." He is clearly sceptical of the merits of the mystical "Coalite" process; but he seems to think that some mode of producing relatively smokeless fuel from coal might prove a commercial success, but that we have not sufficient data available to make a more definite pronouncement. He clearly pins his faith to a larger yield of ammonia than is achieved in either gas-works or coke-oven practice, and makes the following statement: "There are means of manipulating coal in such a manner "as to obtain half the amount of the nitrogen as ammonia; "but they have so far not been applicable to gas making, "and in that industry only about one-fifth of the nitrogen "is recovered as ammonia." Later, after referring to the difficulty of computing the value of tar produced at a low temperature of carbonization, he says: "As regards the "quantity of ammonia which might be recovered at a low "temperature, we are even more in the dark."

Dr. Grossmann nowhere alludes to the Mond gas process—perhaps because it is not a coke-making process; but we think that it should be borne in mind when the prospects of "Coalite" are under discussion. Following up the view enunciated by Mr. W. J. A. Butterfield that the staple product of the Mond gas process is ammonia, we get a very interesting comparison of the merits for different purposes of the three important modes of carbonizing coal. Thus, regarding only the three products, gas, coke, and ammonia, the results are broadly—

	Gas.	Coke.	Ammonia.
Gas-Works	*Staple product*; yield and quality good	Yield good, quality indifferent.	15 per cent. yield.
Mond Producer	Yield large, quality bad; being largely products of combustion.	Negligible	*Staple product*; 50-60 per cent. yield.
Coke-Ovens	Yield good, quality indifferent.	*Staple product*; yield and quality good.	Generally neglected; yield of 15-20 per cent. possible.

Now it is obvious that a high yield of ammonia, which Dr. Grossmann regards as the condition of success for a smokeless fuel process, has already been achieved in the Mond gas producer, which utilizes slack coal—that is to say, precisely the raw material from which it is understood "Coalite" is prepared. At what cost is the high yield of ammonia obtained? The loss of virtually the whole of the coke, and the partial combustion of the gas! Yet, under the "Coalite" scheme, it is expected that fuel much superior to coke will be produced, that good gas will be made, and that a high yield of ammonia (and other bye-products) will be secured. Those who hope to make a high yield of ammonia pay for a gas-making process, should study the report of last year's working of the South Staffordshire Mond Gas Company (*ante*, p. 630). Technically, it is practically impossible for a high yield of ammonia to go hand in hand with the production of a good quantity of gas of good quality, even if the coke or other residual solid fuel is wholly sacrificed. The pioneers of "Coalite," however, put the production of such a fuel of high grade in the foreground; and, that being the case, it may be foretold that the yield of ammonia and the yield and quality of gas will pass very far into the background. There is a limit—which is not far from being attained in the gas industry at the present day—to the possible returns from the carbonization of coal, and that limit will certainly not be approached when carbonization stops half way. "An ingenious and absurdly simple "process"—to quote Sir W. H. Bailey's description of "Coalite" manufacture—cannot work technical miracles.

The reference that was made last week to the secrecy that is being maintained over the "Coalite" process can now be supplemented. Sir William Bailey, in the letter from which extracts were made in our last issue (pp. 735, 741), stated that the Coal Smoke Abatement Society had reported on "Coalite" as a fuel. In reply to an application to the Society for a copy of the report, the Secretary courteously informs us that the report has not been made public; but "possibly the proprietors of 'Coalite' might be willing to "let you see it." We are afraid the Secretary of the Society does not know much about the liberality of the proprietors of "Coalite" in giving information to the Technical Press; but, knowing what we do, time has not been wasted in a journey or in starting correspondence that would have been unrewarded.

Nottingham Gas Inquiry.

Although the Committee presided over by the Mayor of Nottingham have held several sittings, and evidence of an exhaustive character has been taken, there is a growing feeling locally that the proceedings are more or less in the nature of whipping a dead horse. In numerous reports to the Council the Engineer had from time to time made his position clear; and while his testimony serves to accentuate the importance of the views which he had previously consistently enunciated, it is more or less in the nature of a repetition, as to substantial facts, of much that was already known. What the public appear desirous of obtaining information about are some piquant details which it is understood were brought under the notice of the Special Committee of Investigation. But, as long as the law remains what it is and the Committee now sitting are impotent to grant indemnity to witnesses against possible subsequent legal proceedings, it is doubtful if the curtain will ever be drawn fully aside. That in regard to engineering details Mr. Brown has presented a case which abundantly supports the views which he has from

the first upheld, the inquiry has already made unmistakably clear. Though it seemed a trifle bizarre for non-technical committee-men to be examining on points of engineering detail, Mr. Brown invested his replies with characteristic lucidity. But, after all, merely the fringe of the matter has been touched from the point of view of the ratepayer, who is desirous of knowing something as to the means whereby Trades Union influence, as represented by the gas workers, has been brought to bear in favour of a particular section in the Council, upon a basis which has often proved inimical to the commercial interests of the Corporation gas undertaking. As long as that is all skilfully deleted, the inquiry becomes more or less in the nature of a solemn farce. Nottingham is not the only place in which, acting through pliable representatives, Trades Unionism has been allowed to "rule the roast" in regard to important sections of municipal work; and the time has arrived when obviously it would be to the general interest of ratepayers if there were some authority invested with statutory powers to deal with these matters in no uncertain way.

London Gas Testings.

We have redeemed our promise, in other columns, to make further examination of the London County Council returns of gas testings. From the results of the testings are shown the advantages that recent legislation has conferred relatively upon the three Metropolitan Gas Companies; and among the points made is the one that the South Metropolitan Company, who bore the brunt of the fighting for the reduction and the proper testing of illuminating power, have, in adhering solely to coal-gas manufacture, scored the least in benefit. Another point advanced for consideration is that provincial companies supplying straight coal gas of 16-candle power and under should now ponder well, if pressed for a reduction of standard price, the comparative value of the loss of standard price and the reduction of prescribed illuminating power. Circumstances can be pictured (where coal gas only is supplied, and gas makers cannot "free-wheel" as they can do when in possession of water-gas plant) where it might be better to secure modern testing conditions, and for the present leave the existing (if readily attainable in working) prescribed illuminating power alone. But all the same we have a great liking for the liberty given by low prescribed illuminating powers. Lessons are also drawn from the returns regarding flat-flame testing, calorific power, and sulphur purification.

Fate of the Metric Bill.

Last Friday, after a debate, in the course of which both sides of the case were most ably put forward, the House of Commons decided—by 150 to 118 votes—that the Weights and Measures (Metric System) Bill should not be read a second time. As with other highly controversial subjects, the decision of Parliament is not likely to be universally accepted as a final settlement of the rights or wrongs of the case. Those manufacturers and traders, however, who were fearful of the expense that would be entailed on them by a compulsory change in their system of weights and measures will breathe more freely, for a time at any rate; while those others who believe that their businesses would be materially assisted by the alteration, are free to test the metric system by introducing it at their works in the same way as has been done at Kynoch's by Mr. Arthur Chamberlain, whose attitude on the question was referred to in the "JOURNAL" a short time ago. The Bill which was rejected last week suggested that the change should come into operation within three years (which was an improvement on the two years proposed by the 1904 Bill); and its introducer, Mr. Straus, pointed out that resolutions in favour of the measure had been passed by the London County Council and by numerous other bodies, as well as by the heads of many trade and engineering firms and members of Trade Unions, who presumably agreed with him as to the "three reasons" why the Bill should be read a second time—namely, the loss of time and money in business and trade involved in the present system, the most serious waste of time in the education of children, and the loss of commerce with other countries owing to our dealing in weights and measures which to them were incomprehensible. Had there been any school children present at the debate, it is easy to imagine which way their sympathies would have gone, when they heard Mr. Straus say a French elementary schoolmaster had estimated that his pupils learnt compound arithmetic in twenty hours, for which English children required four hundred hours; and that while the metric system could be put into seventy-two words, ours required many thousands. This, however, is only one side of the case; and Mr. Haworth, moving "that the Bill be read a second time this day six months," pointed to the enormous cost that the change would entail, and to the fact that though thirty-seven out of forty countries had adopted the metric system the "miserable minority" of three consisted of Russia, the United States, and Great Britain, who in respect of population and commerce in reality constituted a majority. He referred to the many firms and organizations who were opposed to the alteration, and urged that, instead of tyrannically forcing it upon them, the people should be left to adopt the metric system or not as they thought fit. Mr. Lloyd-George admirably summed up the debate; and, while admitting that if it were possible to introduce the metric system without doing any great injury to trade everybody would be glad of it, he contended that until traders and manufacturers came to some understanding on the matter, Parliament would be acting unwisely in forcing upon the country a measure for which it was unripe.

Income-Tax.

Agitation has been commenced, and it is hoped will be actively persisted in, with the view of securing some mitigation of the lot of the income-tax payer. The tax is, everybody admits, in the present times of peace, too high, and its incidence unjust. It presses heavily on the middle salary-earning class; and it is that middle salary-earning class whose savings—we remember Sir George Livesey calling attention to this point some time since—supply a large proportion of the capital employed in the industry of this country. On their savings income-tax has been paid; and on the product of their savings, income-tax is also paid. It is not contended that on the latter income-tax should not be levied. But the tax has become, whatever its original intention as an emergency or war tax, a part of the permanent finance of the country; and we do hold that a tax, in periods of peace, of 1s. in the pound is an unjust and indefensible impost on the industrious and the thrifty. Before the Boer war, 8d. in the pound was regarded as a fair and normal rate for the tax. It is about five years since the close of the war; and the burden still stands at 1s.—notwithstanding that 1d. in the pound now produces £2,600,000, compared with £2,000,000 before the war. The country is very prosperous just now; and the hope is being indulged that the Chancellor of the Exchequer will have a surplus of about 5 millions with which to deal. The time is therefore favourable for agitation, so as to impress the views of the country on the Government. Mr. Gladstone once said that "the facility for recurring to, and maintaining, the income-tax, had been the main source of extravagant government;" and in this he was not far wrong. The shareholders in gas companies, large numbers of whom are dependent upon the modest returns they receive on their investments, will heartily welcome an abatement of the burden that has so long been imposed, and that Chancellors of the Exchequer have been so unwilling to relinquish. The "facility" for maintaining the tax at a high level has by them been, in late years, demonstrated up to the hilt.

With regret, we have to announce the death on the 22nd inst., in his 71st year, of Mr. THOMAS HENRY GOODWIN NEWTON, who for the long period of 43 years was connected with the administrative work of the Imperial Continental Gas Association. An auditorship was the stepping-stone to the more responsible office of Director; and of the Board he was a member for 39 years. His services for the Association resulted in his elevation to the chair in succession to the late Sir Julian Goldsmidt. For many years, he presided over the fortunes of the great undertaking with conscientiousness, ability, and a broad-minded regard for those immediately associated with him and for the officers and staffs of the concern. In the opening years of the new century, it was obvious that his health was failing; and there came the break in his appearance at the proprietors' meetings at the first one held in 1903. Then Mr. J. Horsley Palmer presided; but before the next half-year's meeting, the proprietors had learned that the arduous duties devolving upon the Chairman of such an important concern had necessitated Mr. Newton relinquishing the burdens of the chair, which Mr. Palmer then took up. Mr. Newton's vast experience, however, was not entirely lost to the Board, membership of which he retained. But though in travel and other ways he sought recuperation, his health did not mend; and he felt constrained to finally retire from participation in the direction in the early part of 1906. The records of the Association will memorize his long and faithful service during a period in which many events of vast importance to the concern occurred.

NOTES FROM WESTMINSTER.

When the stirring times of a few years ago in the Committee-rooms and corridors are remembered, when Counsel and witnesses rushed in feverish haste from room to room, the present torpor is somewhat dispiriting. Everyone tries to look happy; but there are those who are largely dependent on Committee work who while on one engagement are musing profoundly on the question as to when the next one is likely to come along. Unless there is some tangible recompense attaching to the infliction, one does not appreciate spending day after day in a room listening to gentlemen all of whom would, if asked, claim to be Truth incarnate, flatly contradicting each other as to the eligibility or otherwise of particular sites for gas-works. That was practically all that was happening last week in the Committee-rooms from which a spark of interest could be raised; and therefore one can conscientiously write that things were very flat. Settlement continues to do its peaceful work, and the busier becomes the Unopposed Bills Committee. The Easter recess will be quite a relief, as it will give a break to monotony; and then on April 9 we are promised a turn with the Hull Purchase Bill before the Police and Sanitary Committee. Announcement was made last week as to the terms of settlement in the Mitcham and Wimbledon Gas Company's Bill; and there has only been an adjustment of clauses since. On Tuesday a fresh Committee, presided over by Mr. A. Hutton, started to investigate the requirements of the Worthing Gas Company and the grievances of their opponents. The Unopposed Bills Committee considered a few Bills—Brockenhurst, Maidstone, and Grays—on Friday. They would have disposed of them the previous day, had not the Commons got into such a peculiar state that the members persisted in extending one sitting over the length of time that it took the small hand of the clock to traverse the face twice. An all-night sitting is just one of the pleasantries of parliamentary life. No particular point arose on the Unopposed Bills referred to.

A Question of Site. The Worthing Gas Company's request to Parliament is for land purchase powers (it being necessary to start new works), for authorization to extend their limits of supply, and to consolidate and convert their capital, and for sanction to additional money powers. The financial part of the Bill did not evoke any hostility; but the site which Sir George Livesey, Mr. Charles Hunt, Mr. Joseph Cash and Mr. W. A. Walker, the Company's Engineer and Manager, said was the best one obtainable for that economy of working which would benefit community and Company alike, was opposed by landowners. Though Rural and Parish Councils appeared, it was freely admitted that it was a landowners' opposition. The chosen site is at Goring, outside the boundaries of the borough of Worthing, it adjoins a railway, and is 18 acres in extent. It is desired to erect as quickly as possible a holder upon the site, and connect with the old works by a high-pressure main. The present holder accommodation is only about two-thirds of the maximum daily output; so that safety ought not to allow the provision of supplementary storage to be delayed any longer than is necessary. The opposition pointed out another site, which their witness, Mr. E. H. Stevenson had done the honour of inspecting from a railway train—in motion or otherwise was not disclosed. The suggested alternative site seemed to suffer from the disability of having no decent means of access such as are required by a gas-works. A trifle like this was airily disposed of by Mr. Stevenson. The Hon. J. D. Fitzgerald, K.C., for the local Councils (Mr. Ram, K.C., was for the landowners), treated those present on Wednesday afternoon to quite a nice homily, delivered in suitably solemn tone, on "Bear ye one another's burdens;" but somehow or other he twisted his discourse round so that it was forced upon the Committee's notice that Goring, generous minded as the people presumably are, did not want to accept the injunction, in its literal or other sense, by bearing the burden and the supposed "nuisance" of Worthing's gas-works, and all the fancied evils that gas-works bring in their train. We do not yet know what the upshot of the matter is, seeing that the Committee have been in communication with the Board of Trade regarding certain points, and could not receive their answer until yesterday afternoon. The parties were therefore informed that the Committee would announce their decision to-day (Tuesday).

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 836.)

The Stock Exchange has had another very disheartening week—fits of depression alternating with fallacious symptoms of amendment. The opening brought little promise; for the American war in Wall Street was raging again, and another failure was announced. The next day was as bad, or worse, and accounts were eagerly liquidated; but Consols kept up. Then followed a rather brighter pause; but this was soon overcast by a rise in the French bank rate—a phenomenon which had not occurred for nearly seven years. Much anxiety regarding future monetary movements was produced; and on Friday the dominant idea seemed to be that accounts had better be liquidated quickly. The tone on Saturday was very bad. Prices crumbled away, and one thing dragged down another; while the gravest apprehensions were entertained that the approaching settlement would involve a train of disasters. In the Money Market, there was always an abundant supply to meet the demand for short loans; but discount rates hardened considerably as bills were not readily taken. Business in the Gas Market was remarkable, there being an unusually large number of transactions in the two leading issues. But these were for the most part condensed into the first half of the week, leaving the last half conspicuously barren. Movements were rather mixed, some being one way and some the other. But on balance, the rises outnumbered the falls; and the prevailing tendency was not unfavourable. In Gaslight and Coke issues, the ordinary was very active and very steady; a large number of dealings taking place at the same figures and within the same limits as the week before—viz., 95⅛ to 96¼. Some moderate business was done in the secured issues; the maximum changing hands at 87½ and 89; the preference, at from 106 to 107; and the debenture, at from 82½ to 84. South Metropolitan showed increased activity, and transactions ranged from 121 to 122½. Commercial were almost entirely neglected; no business being marked except a couple of deals in the 4 per cent. at 108 and 109. The Suburban and Provincial group were a little more animated. Bournemouth original marked 27⅝ and 27¾ (after which the quotation rose ¼), ditto "B" 16½, Brentford new 194, Brighton original 223, North Middlesex 19½, Wandsworth "B" 140, West Ham 102½, ditto preference 122, while the quotations of British and Bromley had a slight advance. The Continental Gas Companies were rather quieter. Imperial was weaker, with transactions at from 179 to 177, and one special at 176—the quotation falling 2; Union marked 121½ and 121 (a fall of 1); and European part-paid was done at 18½ and 18¾. Among the undertakings of the remoter world, Buenos Ayres changed hands at 11⅝, ditto debenture at 94½ and 93¼, Primitiva at 7⅝, ditto preference at from 5 to 5⅛, ditto debenture at 95⅛ and 96, River Plate at 12⅜ and 12⅝, ditto debenture at 95½ and 95¾, San Paulo at from 13¼ to 13⅜, Cape Town debentures at 52 and 52½ (a rise of 1), and Melbourne 5 per cent. at 101½.

AN INTERNATIONAL GAS EXHIBITION FOR PARIS

A circular, under date of the 21st inst., has been issued by the Société Technique de l'Industrie du Gaz en France, announcing that it is suggested to hold in Paris an International Gas Exhibition, under the auspices of the French Gas Society, the "Chambre Syndicale de l'Industrie du Gaz," and the "Chambre Syndicale de l'Eclairage et du Chauffage par le Gaz." The idea, as the circular states, has originated in the successful gas exhibition at Earl's Court in 1904, which, it will be remembered, was honoured by a visit of representatives of France and other countries. A Provisional Organizing Committee has already been appointed; and they think that the present time is an opportune one for the launching of a comprehensive exhibition.

The circular says that "the comparison of statistics from abroad with the figures of our own country shows how much we are still behindhand in France in the utilization of coal gas, and gives us an insight into what we may rightly hope for and obtain. We think, therefore, that, in order to drive the public out of its indifference as regards the uses of gas, it is necessary to make a *grand coup*." It is hoped to make the proposed exhibition truly international, so that the public will be able to compare French and foreign apparatus, and also lead French manufacturers to make progress and to take note of new ideas from whatever quarter they originate.

An appeal is made for the guaranteed sum of 250,000 francs (£10,000), which, or at least some of which, it is of course hoped will be returned should the exhibition prove a success.

It is proposed to classify the exhibits into eleven groups, as follows: (1) Works' Plant; (2) Coal; (3) Lighting; (4) Heating and Ventilation; (5) Motive Power; (6) Gas Measurement; (7) Direct Bye-Products; (8) Laboratory and Testing Apparatus; (9) Various Industries relating to Gas; (10) Hygiene; (11) Gas Technics: Documentary, Legislative, and Economic.

The date suggested for the exhibition is from September to November, 1908. The patronage of public authorities, the Municipality of Paris, and the assistance of foreign Gas Societies is asked for. Here, on our part, we can only say that we welcome the suggestion, and heartily wish our French friends the greatest possible success with their exhibition.

The Chemistry of the Rare Earths.—At a recent meeting of the Chemical Society, Signor Mario Esposito submitted a further communication on the above subject. He showed therein that the methods of Muthmann and Böhm and Pattinson and Clarke for the preparation of ceria, have been found to give a fairly pure product. Oxidation with potassium permanganate, according to Drossbach and Böhm's method, is probably the most rapid and satisfactory way of obtaining almost pure ceria. Lanthana and old didymia can be separated by fractional crystallization of the oxalates from strong nitric acid; but the process is not advantageous. Lanthana is best obtained by a modification of the method of Baron Auer von Welsbach (fractional crystallization of the double ammonium nitrates), which at the same time effects the separation of neodymia and praseodymia, the chief constituents of old didymia.

ELECTRIC LIGHTING MEMORANDA.

Flame Arcs—Disappointed Shopkeepers—A Broad-Minded Writer—Difficulties and Light Distribution—"Progress" in Complication—Public Lighting Complaints—Municipal Mismanagement.

EXPERIENCE has a wonderfully chastening effect. A few months ago, it was impossible to look into our electrical contemporaries without being greeted with almost hilarious references to flame arc lamps and their so-called successes. But the lamps are dealt with now in a more sober and business-like spirit. The flame arc lamp is not all that the electrical industry expected it would be, nor is it doing for the industry all that was anticipated. A few of these lamps, used for outside shop window lighting, have been under special observation by us. The proprietor of one of two shops has had the lamps removed, and incandescent gas-lamps have again been installed. At a second shop, the proprietor is complaining of the extra expense and trouble of the lights; and his lady customers are adding to his annoyance by complaining that the row of dazzling lights outside his window prevents them properly inspecting the goods displayed inside. That is not what the proprietor intended in going to the expense he did in installing the lights. The flame arcs may attract from the distance, but they repel on closer acquaintance. The shopkeeper does not want, by over-doing the lighting, to defeat the object of the display of goods in the window. The same shopkeeper reports that, though his expenses for lighting have risen considerably during the winter months, compared with the preceding winter, when incandescent gas lighting was employed, he fails to find the *quid pro quo* in his account books. He is a disappointed man; and we are anticipating that the experience will have as its result, when deterioration has completed its work of rendering the lamps useless, that clusters of incandescent gas-burners, which have no dependence on internal mechanism of any kind and are free of all complication, will reign again in the positions from which they have, we believe, only been temporarily ejected. Meanwhile, this shopkeeper is making no secret of the want of success of the flame arcs among his fellow tradesmen, and though these tradesmen have been invited to change over, have been interviewed, and have heard all manner of evil things said against their present system of lighting, they sit tight, contented with the testimony of a neighbour, without paying for the experience.

Mr. H. S. Hatfield, B.Sc., has been writing on the subject of flame arc lamps in "The Electrician." It is rather significant that he opens the article with these words: "There can be no question that the flame lamp represents the most efficient form of electric lighting—at any rate, as regards energy consumption—which is known at the present day." Mr. Hatfield was wise in incorporating the qualifying words, "at any rate as regards energy consumption," because, looked at from other points of view than energy consumption, there are users (such as the shopkeepers before mentioned) who would be disposed to question the statement. It is strange but true that the electric lamps that are the most efficient in energy consumption are the ones that give the most trouble; and those that give the least trouble are those that are the most extravagant in energy consumption. Mr. Hatfield does not simulate unconsciousness (as is a pretty and amusing habit of some electricians) of the existence of anything good in incandescent gas lighting, for he says "that the flame lamp comes at an opportune moment to enable electric lighting to meet the formidable competition of high-pressure gas lighting." When broad-mindedness of this kind is found in the writings of friends of the electrical industry, it always puts one in a respectful frame of mind, and creates a desire to know more of what such a man has to say. Well, having in view this "formidable competition," it is urged by Mr. Hatfield that practice and design of flame arcs should undergo as rapid an evolution as possible, and that the problem of providing mechanism suited to the peculiar conditions should be clearly understood. He admits that, at the present time, in this branch of the electrical business, things are in a transition state; and therefore, it may be suggested that while the lamps are *en route* to a more perfect state, shopkeepers and street lighting authorities would do well to pause, before spending money on them, to see whether that more perfect state is reached. There seem to be so many pitfalls in the road to perfection in electric lighting! The difficulties are substantial with which the electrical industry has to deal in producing the more perfect lamp. Mr. Hatfield mentions three: First of all, the rapidity of the consumption of the flame carbon as compared with the carbon in an ordinary type lamp; secondly, high prices and considerable fragility of carbons impregnated with metallic salts; thirdly, the copious evolution of metallic salt from the carbons from their burning, which endangers insulation, causes clogging of the mechanism and increased friction, and sometimes prevents half-burnt carbon ends making contact on switching on. These difficulties are so clearly put that they do not require elaboration to emphasize them.

There is perhaps nothing more admirable than candour in a writer; and we get it again in Mr. Hatfield when he tells us that a certain proportion of the increased efficiency of flame arc lamps is, no doubt, due "to the high reflecting power of the economizer, which is kept continually whitened by the calcium fluoride evolved from the carbons; and a certain *illusory increase in efficiency is gained by the unequal distribution of the light, which is a positive disadvantage in street lighting.* But, in the opinion of the writer, there is an actual increase in efficiency which is most probably due to some cause which our entire ignorance of the nature of the actions going on in the flame arc prevents our being able to explain." The foregoing is a little involved in construction; but what Mr. Hatfield means seems sufficiently plain. Some of his words—those italicized here—quite fit what we have been saying in the "JOURNAL" for a long time past, that there is much that is illusory in the flame arc lamp, and that the character of the light and its unequal distribution are positive disadvantages in street lighting. Reverting to the difficulties mentioned in the preceding paragraph, it is a great pity—or rather we suspect our electrical friends think it is so—that "progress" in electric lamp construction runs in the direction opposite to that which progress in invention should take, and usually does take. Progress should be towards simplification, but it cannot be said that it is the case with electric lamps. The organism of the flame arc lamps is not simpler than that of the ordinary arc; and the metallic filament lamp is not an advance in simplicity upon the carbon filament lamp. The short life of the chemical carbons of the flame arc lamps has necessitated the use of fairly long carbons to obtain a reasonable life; and carbon magazines (long the ambition of the electrician, but ever troublesome even for ordinary arc lamps) have again been tried. But if they could not be made successful with lamps using carbons without metallic salts, how much more difficult will it be to keep the magazines in good running order with the "copious evolutions of metallic salt from the carbons from their burning." Many electricians have put in these magazine lamps in lengths of streets the lighting of which is under their control. The recommendation was their own, their Committees accepted their word, the price has been paid, the worry is the electricians', and little they say about it to their Committees. Dignity compels silence; and so does their personal composure. The greater part of Mr. Hatfield's article is devoted to the explanation of a patent by Mr. Frank Lewis, whereby he has—it is hoped by the electricians successfully—overcome the use of the commonly used clockwork feed for carbons in flame arc lamps. It does not require a large amount of intelligence to see that if clockwork is undesirable in an arc lamp of the common type, in a flame arc lamp it is especially so.

It is impossible to keep off the question of public lighting for any great length of time. This is not our fault; it is the fault of those grumblers—and they are ubiquitous—who are constantly objecting to the cost and to the effect of electric lighting in the streets. Mr. Stapleton started the matter again in the Croydon Town Council the other day, by expressing the opinion that the arc lamps are not giving full value for their money. That is the difficulty. There are few places where they do give full value for money; and yet there are very few places where the electric light undertakings are municipally owned where the money received for the street lighting by electricity really pays the department. We could show Mr. Stapleton a good many examples of arc lighting in London, and quote the prices paid, which would convince him that what he experiences at Croydon is not unique. There is not the slightest question that Mr. Stapleton was speaking with moderation, because Alderman Lillico urged the taking of some "serious steps" in connection with the arc lamps. "Serious steps" look as though things were terribly bad. The Alderman is also impressed by the fact that the Council are paying, for lighting 17 miles of streets by electricity, as much as, if not more than, they are paying for lighting the whole of the remaining 127 or so miles of streets which are lighted by incandescent gas-lamps. Observe the variation in mileage; the equality in expense. The vast majority of the ratepayers live, move, and have their being in streets that a reunlighted by electricity. What does it profit the majority that a small minority should live, move, and have their being in streets lighted in a very costly and indifferent manner—that is to say, at a cost per annum about nine times more per mile than the cost of the gas-lighted streets of the majority, who, being the majority, have to pay the largest amount towards the lighting of the thoroughfares of the minority. It is an unjust world, and who will say it has not become more so with the advance of municipal trading in electricity? Defence at the Croydon Council meeting was attempted by Mr. Betteridge, who agreed that the charge of £17 per arc lamp was a large one; but, in extenuation, he remarked that, compared with the charges by other corporate bodies, it was a reasonable amount. Which is tantamount to arguing that two blacks make a white. Some corporate bodies, of course, do charge steeply; others do not charge enough to pay them. We have a suspicion that the Electric Lighting Committee at Croydon are not charging a paying price at £14 for flame arc lamps, including the chemical carbons, attendance, and so forth; and it would be interesting to have an opportunity of examining into the items making up the £14 charge. An average of £55 8s. per mile of road is paid for the incandescent gas lighting. That £55 8s. would only allow of four flame arc lamps (at £14 each) being put up in a mile of thoroughfare. So distributed, it would be instructive to see what sort of a job the lamps made of the lighting of the mile. One cannot, with large centres of illumination such as flame arcs, which do not diffuse their light well, have at the same time fairly uniform illumination and cheapness. It is of interest to learn, from a letter by Mr. J. W. Helps in a local paper, that the offer remains open of the Croydon and South Suburban Gas Companies (which was submitted some time ago) to light with gas free of charge for six months, for comparison with electric arc lighting, a selected section of the town in such

a manner as would represent an annual saving in cost to the Corporation on the lighting of the town equal to a rate of 1d. in the pound. What is it that keeps the Corporation from accepting this liberal offer and fair challenge?

If ever justification has been required for the careful scrutiny that has lately been given to electricity works under municipal management by Inspectors of the Local Government Board and others, it is furnished by the miserable muddle into which incompetence has brought the electricity undertaking of the Woolwich Borough Council. Sir Alexander B. W. Kennedy and the Local Government Board Auditor (Mr. A. Carson Roberts) have furnished the gruesome details which make no condemnation of the late administration at Woolwich too severe; and those details would, in several respects, apply more or less to many a similar concern under municipal control. There is Sir Alexander's deliberate opinion that serious mistakes were made in the erection of the Woolwich works; and he believes the undertaking can never be made profitable in two of the districts to which current has been carried. This shows that the Council have been either ill-advised in technical matters right from the start, or that, if the technical advice was good, then the amateur electricians forming the majority of the Council—for, of course, the old majority were all electricians, or thought they were—"improved" on the advice tendered to them. However that may be, the technical officers had no commanding power regarding finance. What has happened in that respect has been painted in vivid colours by Mr. Carson Roberts. The accounts have not shown the full amount of the losses, nor have the deficiencies by any means been dealt with in making the rates. The understatements of losses have increased; and they—the understatements—appear to have involved about £3000 per annum. The average charge for street lighting has been about 3¼d. per unit for current alone, apart from other charges [compare this with the charge for power and heating]; while the corresponding charge in other parts of the Metropolis averages between 1½d. and 2d. per unit. Legally, under the Provisional Order, the Council should not charge quite 2d. per unit in the current year for public lighting; and so the reduction in income from this source this year should be about £1200. No charge at all has been made on the undertaking for office accommodation in the Town Hall; and no charge has been made upon it for the services of the Town Clerk, the Borough Treasurer, and their assistants. The outcome is that the Auditor calculates that the rate to cover the deficiencies in the revenue of the undertaking will range from 5d. to 8d. in the pound per annum. Then there has to be taken into account the coming burden of £18,000, instead of £12,000 per annum by loan service charge. The ratings in aid of the concern up to March 31, 1906, which amounted to a total of £20,164, have left arrears of deficiencies amounting to £9668. That is all bad enough; but in proportion, from the financial point of view, the facts are worse in connection with the trading in wiring and fitting installations, motors, &c. Both the Auditor and Sir A. B. Kennedy recognize this; and the latter recommends the discontinuance of this business. Sir Alexander also considers that it will be at least ten years before the undertaking can possibly make both ends meet; and this can only be done by a reduction of the costs of production and an increase in the price to the consumers. Truly a nice outlook for ratepayers and consumers alike! The reports on the subject are long ones; but it would pay every municipal authority to take them as a good example of how not to run electricity works, and as a guide to see whether in any respect the criticisms would apply to their own concerns; and, if they do, to set about mending them without delay.

A Welsbach Mantle in a Hydrogen Flame Burning in Chlorine.

In a recent number of the "Journal für Gasbeleuchtung," Dr. C. Killing describes an experiment in which he plunged an incandescent burner consuming hydrogen into an atmosphere of chlorine. It is, of course, well known that just as hydrogen burns in oxygen to produce water, so hydrogen will "burn" in chlorine, or chlorine "burn" in hydrogen, yielding hydrochloric acid gas. Dr. Killing connected a holder containing hydrogen by means of a rubber pipe to a length of glass tube bent at one end into the shape of a U. To the shorter limb he then fitted a steatite burner and an incandescent mantle (a "Baby" mantle) carried on an ordinary clay prop. The hydrogen was ignited and allowed to play on the mantle while the burner was in the air, and it was then plunged into a tall cylindrical glass vessel, open at the top, and filled with chlorine. In these conditions, though no metal was present about the flame, the mantle gave a greenish light of extraordinary brilliancy. At the end of the test, the mantle appeared to be wholly unchanged, and on analysis was found to contain no trace of either thorium or cerium chloride. The author considers his experiment to prove that when an incandescent mantle is used in ordinary conditions, the cerium oxide does not play any part as a carrier of oxygen; but it still leaves the question undecided as to the true reason for the high luminosity of the mantle, unless the reason is that the mantle is brought by the flame to a temperature which is not exceeded even in an electric lamp yielding the whitest light.

Mr. R. C. Pearson has joined Mr. Alexander Watson and Mr. Charles E. Murray on the Board of Wilson Carter and Pearson, Limited, of Birmingham.

OBITUARY.

MAGNUS OHREN.

We regret that it again falls to our duty to record the severance of another link connecting the present with the past of the gas industry. Last Thursday morning, Mr. Magnus Ohren passed peacefully away, at his residence, "Burleigh," Garlies Road, Forest Hill, in his 86th year.

Mr. Ohren came of an old Swedish family. His great-grandfather was a shipowner who settled in this country; his grandfather held an appointment under the Crown as Surveyor of Sloops; and his father was a wharfinger at Rotherhithe, where the son Magnus was born on Dec. 8, 1821. He was therefore an Englishman by birth, as he was in sentiment and disposition. In 1837, at the age of sixteen, his connection with the gas industry commenced by his being articled to Mr. Geddie Pearse, the Engineer-in-Chief of the British Gas Company, whose London works were in School House Lane, Ratcliff. He remained with the Company till 1846, when he went to Hamburg to assist in lighting the city with gas. On his return to England in 1850, he was re-engaged by Mr. Pearse. At that time the Company were short of storage room, and Mr. Ohren had an opportunity of watching the process of telescoping a small holder—a rather novel piece of engineering work in those days—by Mr. Wright (now Messrs. Westwood and Wrights). The works eventually became too small to meet the requirements of the district, and they were acquired by the Commercial Gas Company. Mr. Ohren passed into their service (he was the only officer taken over), and was appointed Superintendent of his old district as well as of Millwall. While with them, he carried out a very successful piece of work in the laying of a 10-inch main in East India Road, to afford a better supply of gas to Millwall from Stepney; thereby obviating the large capital outlay required for the erection of works at the former place, which had been in contemplation. The Crystal Palace District (now the South Suburban) Gas Company was formed in 1854; and the next year Mr. Ohren was appointed Manager of the works. He subsequently became Secretary, and discharged the duties of the two offices until 1865, when they were divided owing to the extraordinarily rapid growth of the undertaking. He held the secretaryship till the autumn of 1893, when, having reached his 72nd year, and his health being much impaired, he sent in his resignation. It was regretfully accepted by the Directors, and his son Charles, who had then been with the Company for 26 years, and was second in the office, was appointed to succeed him. At the spring meeting in 1894, the Chairman (Mr. Frederic Lane Linging) referred to Mr. Ohren's long connection with the Company, and expressed the regret of the Directors at the loss of his services, extending as they had done over a period of 38 years; and their proposal that these should be recognized by the shareholders by the grant of a retiring allowance of £500 per annum was supported by Mr. (now Sir) George Livesey, and acquiesced in with the utmost cordiality. During the time Mr. Ohren was with the Company, he witnessed a truly enormous increase in the consumption of gas.

In the ranks of the gas profession, Mr. Ohren was well known, alike from his technical and his financial connection with it; and he was very highly respected. He was admitted an associate member of the Institution of Civil Engineers on Jan. 11, 1859. He was one of the founders of the Society of Engineers, a fellow of the Chemical Society, and a fellow and one of the members of the Sanitary Institute. He joined the British Association of Gas Managers in 1864, was Acting President in 1870, passed into the Gas Institute, and remained a member till 1888. He joined the Institution of Gas Engineers which was formed in 1890, and was one of the Auditors; and on the amalgamation of the two bodies in 1903, he became a member of the new Institution. He was auditor of several gas companies.

Mr. Ohren was a prominent Mason; his career commencing in 1861, when he was initiated in the Britannic Lodge, No. 33, of which he became W.M. in 1872. He was a Founder and the first Secretary of the Evening Star Lodge, No. 1719, of which he was P.M.; in 1870 he was installed W.M. of the Frederick Lodge of Unity, No. 452, in the Province of Surrey; in 1880 he was appointed Grand Assistant Director of Ceremonies; and he was a Life Governor of, and had twice served Stewardships for, the three Masonic Charities. In addition to his labours in the cause of Masonry and Masonic benevolence, he was an active friend of the local charities of the district in which he resided, and was a subscriber to many others.

The funeral takes place to-day (Tuesday) at Ladywell Cemetery.

WILLIAM WINSTANLEY.

We regret to record the sudden death on the 15th inst., as the result of an apoplectic seizure, of Mr. William Winstanley, the Gas Engineer and Manager of the Newcastle-under-Lyme Corporation. He was engaged upon his ordinary duties of inspection in the town in the morning, and on his return home at midday complained of feeling unwell. Almost immediately afterwards he became unconscious; and on the arrival of two medical men they pronounced the case to be hopeless. He never regained consciousness, and died just after seven o'clock in the evening. Mr. Winstanley had had the management of the gas-works from the time of their acquisition by the Corporation (1881) from the

Newcastle-under-Lyme Gas Company, under powers obtained four years previously; and at the date of the transfer he had been in the Company's service for nearly six years. His business connection with Newcastle, in which he was held in very high esteem, therefore extended over a period of about 32 years. Originally his duties under the Corporation included the secretarial work of the Gas Department; but this was relinquished a few years ago. He was admitted an associate member of the Institution of Civil Engineers on Feb. 1, 1887; he joined the British Association of Gas Managers in 1875, passed into the Gas Institute, and eventually into the Institution of Gas Engineers. He had been a member of the Midland Association of Gas Managers from its formation—having attended the meeting called by the Provisional Committee to start the organization on Oct. 11, 1877.

The funeral took place last Tuesday, at the Newcastle Cemetery; and, in addition to the members of the family, it was attended by the Presidents of the Midland Association and the Manchester District Institution of Gas Engineers (Mr. Hubert Pooley and Mr. William Prince), many professional and private friends, the foreman (Mr. L. Shaw), the members of the staff, and most of the men from the gas-works, by some of the oldest of whom the coffin was borne to its last resting-place. The works were closed for the day, to allow as many as possible of the employees to attend the funeral, which was witnessed by a large gathering of sympathizing spectators. Deceased leaves a widow, three sons, and two daughters.

Mr. Charles Meiklejohn, the Secretary of the Midland Association, has sent the following appreciative remarks on the late Mr. Winstanley: "From the formation of the Association in 1877 to the day of his death, he was most regular in his attendance, and was ever helpful with his cheery support. He was elected a member of the Committee in 1898, and served in that capacity for three years. He never took a very active part in the technical work of the Association; but as a member of it he was always ready to assist his fellow-members with the records of his own experience, given in his own quiet way. This is one phase of the Association's work which is, I think, no less helpful than the more 'stereotyped' form of a written paper. I am sure I am but expressing the opinion of the whole of the members in saying that we shall greatly miss his kind and genial presence."

France and the world of science have alike sustained a great loss by the sudden death, under singularly distressing circumstances, of M. MARCELIN BERTHELOT, the distinguished chemist, which took place on Monday last week. He was in his 80th year, having been born on Oct. 29, 1827. M. Berthelot was the virtual founder of the science of thermo-chemistry, and one of the most successful pioneers in synthetic chemistry; and his distinction as a philosopher, as a writer, and as a great citizen contributed to make his name one of the most justly renowned of the Nineteenth Century in France. He succeeded Pasteur in 1889 as Perpetual Secretary of the Academy of Sciences, was Minister of Public Instruction in 1886-7, and Minister of Foreign Affairs in 1895-6.

Many of our readers will learn with regret of the death of Mr. E. M. PEARSON, the Chairman of Wilson Carter and Pearson, Limited, coal and coke factors and exporters, of Birmingham, which took place on the 14th inst. Early in life Mr. Pearson became associated with the coal trade, entering the offices of the late Mr. Wilson Carter, who as far back as 1848 commenced business at Birmingham and Wigan. Subsequently Mr. Pearson became the sole proprietor, and under his guidance the business was successfully conducted. In 1900 it was converted into a limited company, when Mr. Pearson, while still retaining a keen interest in its welfare, ceased, through failing health, to take an active part in the management. The concern is one of the most highly respected and most successful undertakings in the coal trade, and is extensively associated with the gas industry. Mr. Pearson, through his kind and genial disposition, had endeared himself to a wide circle of friends, and on the Birmingham Coal Exchange a general and profound expression of regret was manifest on the news of his death becoming known. He was a Vice-President of the Birmingham branch of the Coal Trade Benevolent Association from its inception. The funeral took place last Tuesday, at Packwood Church, Warwickshire, when a number of friends were present to pay their last respects to his memory.

On leaving the service of the Wrexham and East Denbighshire Water Company to take up a position as Collector under the Metropolitan Water Board, Mr. T. HARGREAVES was presented with a handsome dining-room clock, subscribed for by the officials and men in the employment of the Company. The Engineer (Mr. F. Storr), in making the presentation, referred to the long time (fifteen years) Mr. Hargreaves had been in the service of the Company, and the high esteem in which he was held by all. He congratulated Mr. Hargreaves on being one of six selected from over a thousand applicants. It was with regret that they parted with one so loyal and zealous in the interests of the Company. He might add that the Directors at their last meeting passed a special resolution acknowledging Mr. Hargreaves' faithful services, and had given a practical expression of their appreciation by granting him an honorarium. Mr. Hargreaves, in thanking the subscribers for their gift, expressed the great regret he felt in severing old ties, but said the opening in London was one not to be missed.

THE RETURNS OF GAS TESTINGS IN LONDON.

WE expressed the intention, at the close of some comments in the "JOURNAL" for the 5th inst. (*ante*, p. 591) on recently published returns of gas testings in London, of making a further inspection of the results at an early date; and in view of the interest which our comments have aroused, we propose to take this opportunity to give a summary of the returns for the first two months of the year, and to offer some remarks thereon. We hope to give from time to time similar summaries of subsequent returns.

It may be well at the outset to indicate what is the scope of the testings here referred to. It will be remembered that the Metropolitan Gas Referees, in recent issues of their "Notification," have prescribed gas-testing places in the Metropolitan area as follows: For the Gaslight and Coke Company, 14 places; for the South Metropolitan Gas Company, 6 places; and for the Commercial Gas Company, 2 places. Of the 14 testing-places for the Gaslight and Coke Company, 3 are within the boundaries of the City of London, and are therefore controlled by the Corporation. We have at present no information as to the results of testings made at these three City testing-places. The remaining eleven testing-places for the Gaslight and Coke Company, and the eight places for the other two Metropolitan Gas Companies, are all under the control of the London County Council; and it is from the returns now issued weekly by the Council that we derive the information from which the appended summary is made. These returns are compiled under the authority of Dr. Frank Clowes, the Chief Chemist and Superintending Gas Examiner to the London County Council.

The returns now issued differ in several particulars from those sent out under the same auspices a few years ago. The provisions of the London Gas Act, 1905, entailed a great alteration in the conditions of gas testing in London. Formerly, all the testings made were "penalty" testings—*i.e.*, the gas company were liable to incur a forfeiture if the testing showed that the gas had not so high an illuminating power or so high a degree of purity as it ought to have had according to the Acts of Parliament or the prescriptions of the Metropolitan Gas Referees. These "penalty" testings included tests (1) for illuminating power in the "London" argand burner, (2) for pressure, (3) for sulphuretted hydrogen, (4) for sulphur otherwise present, (5) for ammonia. Now, however, there is another class of testings—viz., tests made merely for the purpose of affording information, and carrying with them no liability to forfeiture whatever the results may be. The "penalty" testings have been reduced to three, and two of the three are less exacting than those which they replaced. The illuminating power of the gas when burnt in the "Metropolitan" argand burner No. 2 is required to be not half-a-candle or more below the illuminating power prescribed; the gas must not exhibit any trace of sulphuretted hydrogen when tested in a prescribed manner; and the pressure at which the gas is supplied must not fall below a prescribed standard. If the tests made by the officials of the London County Council at the several testing-places show that the gas does not fulfil these three conditions entirely, the gas company are liable to incur a forfeiture. In addition to these testings, which may be made daily (Sundays included), there are three other testings, which, being only for the purpose of supplying information, may be made daily or less frequently at the option of the London County Council, but in any case not on Sundays. These testings are for (1) the illuminating power of the gas when burnt in a prescribed flat-flame burner, (2) the calorific power of the gas, and (3) the amount of sulphur other than in the form of sulphuretted hydrogen present in the gas. It will be noticed that the testing formerly made for ammonia no longer appears in the "penalty" or the "information" class.

The standard illuminating power with the "Metropolitan" argand burner No. 2, half-a-candle below which the average result of three consecutive days' testings may not fall without a forfeiture being incurred, is 16 standard candles for the Gaslight and Coke Company, and 14 standard candles for the South Metropolitan and Commercial Companies. A forfeiture is, however, incurred if the deficiency on any one day is one candle or more. The standard pressure at or above which the gas must be supplied, is 6-10ths between midnight and sunset, and 10-10ths between sunset and midnight.

This epitome of the regulations under which the gas supplied by the three Metropolitan Gas Companies is tested has been given because these regulations are scattered in various Acts and Notifications which have to be construed together in order to arrive at the regulations which are actually in force at the present day. Those not brought face to face with the conditions of gas testing in the Metropolis fail commonly to realize their true significance; and it is therefore hoped that this statement will be of service in setting out their salient features without reference to the mass of relatively unimportant details.

We may now pass on to consider the results of the testings, made under the regulations referred to, in the nineteen testing-places under the control of the London County Council during the months of January and February, or, to be precise, during nine weeks ending March 2. At each of three of the testing-places for the Gaslight and Coke Company, two different streams of gas are tested, so that this Company's supply is, in effect, tested at 14 different points (as well as at 3 places in the City of London). The

results of the "penalty" testings of illuminating power, made with the "Metropolitan" argand burner, show that, in the period under review, the gas supplied by the Gaslight and Coke Company has averaged a little over 16·6 candles, with a maximum result of 18·8 candles, and a minimum of 14·83 candles. The latter result, being over one candle below the standard, should involve the Company in a forfeiture, unless they are able to substantiate a plea of extenuating circumstances before the Chief Gas Examiner. The gas supplied by the South Metropolitan Gas Company has averaged about 16·15 candles, with a maximum result of 18·4 candles and a minimum of 14·3 candles. The Commercial Gas Company have supplied gas averaging about 15·2 candles, with a maximum of 16·8 candles and a minimum of 14·1 candles.

These figures are highly significant, and should be pondered well by gas undertakings who contemplate approaching Parliament for a reduction in their standard illuminating power and a revision of their testing clauses. The South Metropolitan Gas Company, who in 1900 obtained statutory powers reducing their prescribed illuminating power from 16 to 14 candles, had to concede, as a *quid pro quo*, a reduction of 2d. in their maximum price under the sliding-scale. The Commercial Gas Company followed suit by their Act of 1902. The Gaslight and Coke Company, however, dallied, and their statutory illuminating power remained at 16 candles when the London Gas Act, 1905, was passed, in virtue of which ultimately the "Metropolitan" argand burner No. 2 superseded the "London" argand burner No. 1 as the testing-burner. The result of this change of burners appears to be that the South Metropolitan Gas Company are now credited with supplying gas averaging well over 16 candle power, and are apparently—taking the evidence of these figures alone—now deriving little or no benefit from the dearly-bought reduction of their statutory illuminating power to 14 candles in 1900. The Company manufacture coal gas only; and it would seem that they have been unable advantageously to produce coal gas approaching 14-candle power under the new conditions of testing. The Commercial Gas Company, aided by their carburetted water-gas plant, have got down to an average of about 15·2 candles. But even so they can hardly be considered to be benefiting fully by the reduction of their standard illuminating power in 1902 to 14 candles. The Gaslight and Coke Company, having conceded nothing in their standard price under the sliding-scale, are fulfilling their more exacting statutory obligations with gas testing only half-a-candle above that of the South Metropolitan Company. Wittingly or not, the Gaslight and Coke Company have in this respect profited more than their smaller Metropolitan *confrères* by the legislation of the present century. It would thus seem clear that Provincial gas undertakings who have a prescribed illuminating power of 16 candles or less, should hesitate to concede anything on the standard price in consideration of a reduction of illuminating power. They might, in cases, be well advised to leave untouched their present prescribed illuminating power, and confine their efforts to obtaining the same testing conditions as the Metropolitan Companies. If they are supplying only coal gas, this would present itself as the politic course; but if they can dilute the coal gas with less highly illuminating water gas, they may secure some advantage from a reduction in the prescribed illuminating power. Pending some revolution in carbonizing methods, there seems little doubt that honest coal gas cannot be made to average less than 16-candle power when tested under London conditions. *Verb. sap.*

The results of the "information" testings of illuminating power in a flat-flame burner may be briefly noticed. The burner prescribed is Bray's No. 7 economizer (slit) fitted over a Bray's No. 4 regulator (union-jet). The average of the results of all the testings of the gas supplied by the Gaslight and Coke Company during the period under review is about 11·8 candles, or nearly 4·8 candles less than the average of the argand results. The flat-flame average for the South Metropolitan Gas Company is about 11·25 candles, or nearly 4·9 candles less than the argand average. Obviously little can be inferred from these results as to the relative merits for flat-flame lighting of the coal gas supplied by the South Metropolitan Gas Company, and of the mixed gas supplied by the Gaslight and Coke Company. Passing down, however, to the lower grade mixed gas supplied by the Commercial Gas Company, it appears that flat-flame users are at a serious disadvantage. The average of the results of the flat-flame testings of that Company's gas is about 9·45 or (say) 5¼ candles less than the argand average. Comparing only the two mixed-gas supplies, there is a difference of only 1·4 candles between the argand averages of the two Companies north of the Thames, but a difference of nearly 2·4 candles between the flat-flame averages. If, therefore, the flat-flame user has any right to be heard nowadays, his plea that the higher standard of illuminating power best meets his requirements must be granted to be well-founded.

The results reported of testings of calorific power are obviously the "net" values, and therefore almost certainly relatively more favourable to the supplies containing water gas than the "gross" values would have been. Nevertheless, the coal gas of the South Metropolitan Company shows the highest average—viz., 134½ calories per cubic foot, with the mixed gas of the Gaslight and Coke Company only about ½ calorie lower. The Commercial Gas Company's supply is, however, of considerably lower calorific value, averaging 127¼ calories per cubic foot. Again comparing only the two mixed gas supplies, the fall of 1·4 candles in argand illuminating power is attended by a fall of a little more than 6½ calories in the net calorific power, or (say) of 4¾ calories per candle. No doubt this relation is affected to some extent by the proportion of water gas in the mixture. For some reason the London County Council have not seen fit to report the "gross" calorific power, or as a fact to state that the values reported are "net" and not "gross." In the gas industry "calorific power" without qualification is understood to be "gross;" and the returns as published may lead to an under-rating of the calorific value of London gas.

Passing on to the average amounts of sulphur in the gas supplied, it appears, as would be anticipated, that there is somewhat less in the mixed gas than in coal gas. The sulphur in the coal gas supplied by the South Metropolitan Gas Company has averaged about 46½ grains per 100 cubic feet, with a maximum result of 84·1 grains and a minimum of 22·0 grains. That in the mixed gas has averaged 40⅓ grains per 100 cubic feet for the Gaslight and Coke Company, and 38 grains for the Commercial Gas Company; the maxima being 62·6 and 57·1 grains, and the mimima 10·6 and 21·9 grains respectively per 100 cubic feet. We need not now discuss the import (if any) attaching to these figures; but they should be borne in mind when questions arise as to the amount of sulphur which remains in gas which is not purified by means of lime. It would appear that the amount of sulphur in coal gas has increased with the increase in heats of carbonization, since the tests made in London in 1870–73 showed considerably lower results—*i.e.*, an average of 33⅓ grains per 100 cubic feet for the South Metropolitan Company's gas, with a maximum of 44·3 grains. In Butterfield's "Chemistry of Gas Manufacture," 1896 edition (p. 110), the carbon disulphide and other sulphur compounds in coal gas freed from sulphuretted hydrogen are stated to range from 36 to 46 grains per 100 cubic feet. Thus the greater part of the increase in the sulphur in coal gas appears to have occurred with the introduction of high carbonizing temperatures between 1873 and 1896; but even since the latter year there seems, by the figures now published, to have been an appreciable increase, probably owing to the yet more thorough exhaustion of the gaseous products from the coal which is now accomplished. It is improbable, however, that any further appreciable increase in the amount of sulphur in coal gas will take place. In any case it would be unsafe for a gas undertaking making coal gas only to set out to supply gas always containing less than 50 grains of sulphur per 100 cubic feet on the average of a month's working, or (say) 100 grains as a maximum on individual testings, unless it is prepared to revert to the use of sulphided lime in the purifiers.

The presence of sulphuretted hydrogen in the gas has not been recorded against any of the three London Companies during the two months. As to pressure, it has been maintained well above the penalty limit. The average for the Gaslight and Coke Company has been 3·1 inches; for the South Metropolitan Company, 2·6 inches, and for the Commercial Company, 3·4 inches. The testings of pressure are made on the street-lamp columns.

Scottish Junior Gas Association.

The members of the Western District Section of the above-named Association paid a visit last Saturday afternoon to the Philpstoun Oil-Works of Messrs. James Ross and Co., at Falkirk. The party numbered about 35, and they were received by Mr. A. H. Crichton, the resident partner, who described the arrangements proposed, which included a descent into the mine for those who cared to go. A large number of the members availed themselves of the opportunity thus afforded of inspecting underground workings; and both there and on the surface three hours were very pleasantly, and, we believe, profitably, spent. The Directors of the Linlithgow Gas Company and their Manager (Mr. R. M'Nair) being the Oil Company's nearest neighbours connected with the gas industry, were invited to join the party, At the conclusion of the inspection, the visitors were entertained at "high-tea" in a recreation hall which the Company have erected in the village for the benefit of the workmen, and which was used for the first time. We shall take an early opportunity of noticing the visit at greater length. Meanwhile, our readers may be referred to the account of the visit given in "Notes from Scotland."

Reduced Railway Fares for the Institution Meeting in Dublin.—We learn from Mr. Walter T. Dunn, the Secretary of the Institution of Gas Engineers, that the Associated Railway Companies have consented to issue to members attending the Dublin meeting, and to ladies accepting the invitation to the reception, &c., return tickets from any station in the United Kingdom available from Friday, the 14th, to Tuesday, the 25th of June, at a fare-and-a-quarter for the double journey. These tickets will be issued on giving up to the clerk, at the time of booking, vouchers signed by Mr. Dunn, and which will be obtainable on application at the office of the Institution, No. 39, Victoria Street, S.W., on or after Monday, the 3rd of June. One voucher will be necessary for each railway ticket required. Return tickets, available to return on the same day or on the following day (tickets issued on Saturday being valid until Monday), will also be issued from Dublin to places not more than 50 miles distant, at a fare-and-a-quarter (with a minimum of 1s.), on production of the card of membership at any of the booking offices of the various railways in Dublin. Members are reminded of the necessity of securing their rooms without delay; and they may be referred to the paragraph which appeared in the "JOURNAL" last week (p. 747).

THE ILLUMINATING ENGINEERING SOCIETY AND ILLUMINATION NOMENCLATURE.

REFERENCE has been made from time to time in these columns to the work of the Illuminating Engineering Society (U.S.A.), which has just completed its first year of existence, and has now five sections and a total membership of 815.

The President, Mr. L. B. Marks, in giving his report at the annual meeting held in January last, restates and enlarges upon the *raison d'être* of the Society. He says that questions concerning the generation and distribution of electric current and of gas for lighting purposes had in the past received most careful attention. But the problem of obtaining the best illuminating results from these sources had been neglected, and it was for the discussion and solution of this and like problems that the Society had brought together at their meetings electric and gas engineers, architects, designers of globes, reflectors, and fixtures, oculists, chemists, physicists, manufacturers of lighting apparatus, and representatives generally of every field of work in which the question of illumination played the least part. In the discussions and collection of data, good work had been done; and the report claims that advances in the art of illumination had been inaugurated that would otherwise have been practically impossible. The President remarks that the Society had studied, among other things, the type of lamp, the size of light unit, the location and character of fixture, and the kind of globe or reflector which may be best suited to meet the demands of individual conditions of lighting. One of the most important topics dealt with was the need of reducing the intrinsic brightness of light sources, and particularly of such sources as were necessarily within the ordinary field of vision. Mr. Marks instances in the latter connection one case of a post office where a change in this respect allowed some members of the staff to dispense with eye-glasses.

Readers of papers on general illumination must have been struck by the increasing and confusing use of different terms to describe lighting effects; and they will therefore appreciate the President's remarks as to the adoption of definite nomenclature and standards for the proper systemization of illuminating engineering. He says: "At the present time our terminology is at best crude, and very often we are unable to avail ourselves of the benefits of valuable work done by others, because the terms used in public reports of such work are open to misinterpretation. To secure uniformity, the co-operation of the members of the lighting fraternity, not only of this country but of foreign countries, is necessary. Much has already been done by Committees to bring about the standardization desired." The President followed these remarks with an announcement as to the appointment of an International Committee of the Society.

Mr. Marks had at the previous meeting of the Society made reference to the necessity of a nomenclature which all could understand and accept; his remark being induced by the terminology used in Mr. P. S. Millar's paper on "Location of Lamps and Illuminating Efficiency" (as briefly abstracted in the "JOURNAL" last week, p. 740). In this paper, the author had spoken of the efficiency of the lamps (electric) as illuminators as being expressible in "lux per watt;" going on to say that the term "lux per lumen" denoted the efficiency of the illumination irrespective of the efficiency of the lamps. This term he re-defined as the ratio of the illumination to the flux of the light. It was also stated that other expressions—such as "lux per candle power" and "lux per square foot of floor space"—were frequently used in practice. Mr. Millar, in the course of his paper, makes fairly extensive use of the terms "lux" and "lumen," both in the text and the tables. Well might one member honestly confess to being "lost and tangled up" in these terms, and Dr. Bell admit that no apology was necessary for not being familiar with this terminology.

In the use of any nomenclature, consideration should be paid to simplicity, easy comprehension, and legitimate derivation from existing and current expressions. To keep to the question of lighting effect, this is a matter with which illuminating engineers and the general public are equally concerned. Technicians may wisely or unwisely adopt whatever terms they like to describe the laboratory or intrinsic value of any lighting source, be it by mean spherical or hemispherical intensity, by horizontal or angular light rays, or by Mr. Millar's phrase "lumen" as indicating total flux. The customer, however, who requires effective illumination wants it described in plain language, and by terms which can readily be interpreted by knowledge which he already possesses. He is accustomed to measurement in feet, and has some idea of the light given by a candle, and to talk of lighting effect in foot-candles is to talk of something comprehensible, or at least explainable. This is the more reasonable when one remembers that the "candle" is not only the generally used and legal standard in English-speaking countries, but one which is likely to remain in force for many a long year. It would be idle to suggest that it is the best, for this has still to be determined.

The International Photometric Committee, who met at Zurich in 1903, discussed a paper, read by Dr. H. Bunte, on "Technical Standards of Light." The author came to the conclusion that, without discussing the faults of the various standards in use—the Hefner lamp (= 0·877 English candle), the English sperm candle, the German paraffin candle (= 1·05 English candles), the Harcourt 10-candle pentane air gas lamp, and the Carcel lamp (= 9·53 candle)—the Hefner unit commended itself as the most useful. The English equivalents of the various standards, as stated by Dr. Bunte, are given above in parentheses. The Committee, after some discussion, provisionally accepted the values given by Dr. Bunte in his paper, and passed resolutions that comparative photometric testings should be made in Germany, England, and France, for the purpose of establishing the ratios subsisting between these standards. Attention was chiefly to be paid to the Hefner, the Harcourt, and the Carcel lamp.

It will be noted that the parliamentary standard candle is in value the mean of the German candle and 0·1 Carcel; and if, as Professor Lewes remarked at the Zurich meeting, some photometrists in England incline, and perhaps with reason, to the belief that the Harcourt pentane standard is equivalent to 9·8 rather than 10 sperm candles, this value approximates to the average of all the units already referred to. The candle also is nearly exactly $\frac{1}{20}$th of the once suggested Violle platinum unit. A comparison of the Harcourt, Carcel, and Hefner lamps has since been made by Parisian photometrists, and recently submitted to the French Academy of Science, with the result that, taking the Harcourt unit as 10 candles, the mean of the Carcel and Hefner equivalents works out respectively at 9·96 and 0·931 English sperm candles (see *ante*, p. 23).

These figures—obtained by inter-testing, and without direct reference to the primary candle standards—are somewhat different from those already given. Assuming the percentage of experimental error in each series of tests to be negligible, the later tests suggest some corroboration of the opinion that the Harcourt standard is in value slightly under, rather than exactly equal, to 10 English sperm candles. This perhaps is a point for further investigation. In any case, it may be conceded that the difference is too small to prevent the continued employment of the Harcourt as a good and useful English standard. There is, too, a distinct gain in the fact that the Harcourt and the Carcel are, according to the Paris tests, to all intents and purposes, identical units—being in value 1·000 and 0·996 respectively.

These standards, considered as one, may well serve, by the law of majorities, for International purposes; the Hefner unit, unless adjusted to suit, being correlated by some definite factor disclosed by agreed and approved tests. In the meantime, it must be felt that our own units are fairly serviceable standards; and until something definite is universally agreed, it is to be hoped that English writers will keep to English phrasing. It is certainly difficult to see what can be gained by the use of such an expression as "lux," meaning "bougie metre" (= ·0845 cubic foot) and based on a foreign standard and linear measurement, unless these are also to be adopted. Mr. Millar's nomenclature is, in other respects, contradictory in character. He speaks of the lamps tested as being of 16 or 32 candle power, as the case may be, and the height of the fixtures in feet; but, in dealing with illuminating effect, he phrases his results in "lux," or, in other words, bougies and metres.

Little need be said now about the work which the American Society's International Committee on Standards and Nomenclature may do. This is beside the question of present terminology, with which no great difficulty can for the time being be experienced. As Dr. Louis Bell said in the discussion, the whole art of gas lighting, which was the whole art of illumination up to a few years ago, was built on the basis of candles and foot-candles; and until there is some reason to abandon this basis, it would seem the part of wisdom to put our papers and discussions in a form easily translateable into these common terms. The Committee consists of the following members of the Illuminating Engineering Society: Dr. A. C. Humphreys (Chairman), Dr. L. Bell, Professor A. Blondel, Dr. Hans Bunte, Mr. L. B. Marks, Mr. J. W. Howell, Dr. E. P. Hyde, Dr. A. E. Kennelly, Professor Vivian B. Lewes, Dr. E. L. Nichols, Dr. F. Schniewind, Dr. C. H. Sharp, Mr. W. D. Weaver, and Mr. J. G. Woodwell (Secretary).

The international character of the Committee is obviously limited by the comparatively small number of foreign members, but is not inefficiently represented by Professor Lewes (Greenwich), Dr. Bunte (Carlsruhe), and Professor Blondel (Paris). It is to be expected that in any work undertaken the Committee will seek the co-operation of other European photometrists.

The remainder of the President's report deals with matters of organization. In order to distribute as equitably as possible the benefits and privileges of membership, the Society are prepared to form sections in any city or locality in which the local membership is fifty or more. Papers accepted for presentation are submitted to all the sections alike both for reading and discussion. The Council of the Society are generally in a very hopeful frame of mind, and are encouraged by the fact that the membership is showing a healthy and fairly uniform increase.

Tar Mortar.—A recent number of the "Annales des Ponts et Chaussées" contained a description of this material. The constituents are sand, cinders from factories (containing clinkers but not large lumps), and tar from pit coal. The proportions are about 2¾ bushels of sand to 3⅛ gallons of tar. The mixture is prepared like ordinary mortar. The sand is formed into a heap, and a well made in its centre, and filled with tar. Then all is mixed several times with a spade until the tar and sand are homogeneous. At the place where it is to be used, it is simply applied in a coat of the requisite thickness, beaten down, and, if possible, rolled; sand being sprinkled over as on bitumen sidewalks. To cover 12 square yards, 8¼ bushels of mortar composed of sand or cinders with 11 gallons of tar suffice.

SMOKELESS FUEL FROM COAL.

In the "Manchester Guardian" last Tuesday, Dr. J. Grossmann, F.I.C., dealt further with the above subject, to which reference was made in the "Journal" which appeared that day (p. 741).

The author began by pointing out that the enormous development which has taken place within the last fifty years in the chemical and allied industries is greatly due to the utilization of bye-products; and that among those which have obtained the greatest benefit therefrom are those connected with the distillation of coal. He had already shown that the most probable method of obtaining a smokeless fuel would consist in subjecting coal to a similar process; and he thought, therefore, that if the characteristics of the older analogous processes and the points which make them specially remunerative were studied, it would be possible to form fairly accurate deductions with regard to the financial prospects of the manufacture of smokeless fuel. He then went on to refer to the distillation of coal for the production of illuminating gas, and showed that while a ton of coal heated in retorts to a temperature of from 1400° to 1700° Fahr. yields rather more than half-a-ton of coke as a residual, it is of poor quality, the price obtainable for it is considerably less than that paid for the coal, and the revenue derived from it, taking into account the shrinkage in quantity, only amounts to a fraction of the initial expenditure. At the same time, the manufacture and supply of gas produced highly satisfactory results, due to the crude gas containing substances of commercial value which could be removed without detriment to the illuminating power. The chief of these was tar, the practical utilization of which was one of the greatest triumphs of modern chemistry. Besides tar, another valuable substance might be recovered from the crude gas, and this was produced from the nitrogen contained in coal. Nitrogen itself was a substance of no value; but combined with hydrogen in the form of ammonia it was worth £50 per ton. If in the distillation of coal it were possible to convert all the nitrogen it contained into ammonia, the value of the latter would come to 15s. per ton of coal, and would alone fully pay for its cost; but Dr. Grossmann pointed out that no means are known to achieve such a result. Still more extraordinary, he said, were the financial results obtained when making high-class coke by modern methods.

The author next proceeded to deal with the question of how far, and by what means, an industry aiming at the production of smokeless fuel could furnish results approaching those of gas and coke making. He said the starting-point of the manufacture was the same—namely, coal; the ultimate product smokeless fuel—a product standing practically between coal and coke. If the substances which produce smoke were driven off, the quantity of smokeless fuel obtained would be so much less in weight as would correspond to the weight of the volatile matter which had been removed; and this, assuming that the residual fuel were sold at the price of the original coal, would have to be worth a great deal more than the corresponding weight of coal in order to pay all expenses and yield a profit. The profits might be considerably increased if only it were possible to use a low-priced coal or slack, and obtain from it a fuel which could be sold at the price of high-class coal. In that case, "the industry might be carried on profitably, even without the help of bye-products;" and if these, of a remunerative nature, were recovered as well, the author expressed the opinion that it would be "very similar to that of modern coke-oven works."

In regard to the production of this smokeless fuel, Dr. Grossmann said the main difference in manufacture would be in the temperature of distillation. On this point he said:

> At the white heat which is maintained in the coke-ovens, all the available hydrogen is driven off from the coal; and the residuum, being practically free from it, assumes the character of coke. In manufacturing smokeless fuel which shall still exhibit the characteristics of coal, it will be important to regulate the operation in such a manner as to leave sufficient hydrogen and oxygen in the residual product; and in order to effect this, it will be necessary to carry on the distillation at a comparatively low temperature and over a short time. Under these conditions, the tar produced will not only be less in quantity but also different in quality from that produced in gas and coke works, and we have at present no data to determine its value. As regards the quantity of ammonia which might be recovered at a low temperature, we are even more in the dark.

He concluded by pointing out that the object of his articles had been to explain, both chemically and financially, the possibilities of a new industry which indirectly aims at the solution of the important problem of the purification of the atmosphere, in which all are interested.

In connection with the foregoing, it may not be uninteresting to reproduce the following remarks, contained in the current number of the "Iron and Coal Trades Review," on the process to be employed in the manufacture of "Coalite."

> In regard to the process to be employed in the manufacture of "Coalite," we understand, from private information, that the reports to which we have previously referred are not quite correct in some particulars. It appears more likely that the coal is treated with superheated steam, and the Company are said to rely very largely for the success of their undertaking upon securing as a bye-product petrol instead of tar. If it be true that from 4 to 5 gallons of the latter, at 1s. or more per gallon, can really be extracted from each ton of coal, as it is suggested, and the quality is good, this particular part of the scheme might be profitable enough. Such a claim would be likely to meet with some incredulity. In any case, the process of manufacture, as a whole, bids fair to be an expensive one, and may perhaps turn out to be more costly when operations are commenced on a commercial scale at the works which it is stated are to be erected at Trafford Park than has been apparent from the results attained by the experimental plant at Wolverhampton. Superheated steam is not the least troublesome of agents to employ; and whereas the actual manufacturing costs of coke are (say) about 1s. 6d. per ton, those of "Coalite," it is calculated, will be at least half as much again. In regard to competition with coal, it will, of course, be the manufactured article trying to force a way into the market against the raw material; and unless the expected profits on petrol prove to be so good that "Coalite" can be sold at a very low price, it may not be an easy matter. Moreover, it must not be forgotten that the new fuel is stated to contain only about 10 per cent. of volatile matter, and it is therefore difficult to light. This is a serious matter as far as its application to household purposes is concerned, while unless it is really cheaper in the long run than ordinary domestic coal, people are not likely to burn it simply because it is smokeless, or nearly so, unless the smoke abatement enthusiasts succeed in getting a Bill passed in favour of the movement, and that is very unlikely just at present. . . . Upon the data available, it is not possible to form any very definite views as to the Company's prospects; but if the reports be true which are current as to the enormously inflated prices at which shares are changing hands, we should hardly regard as latter-day Solomons those investors who are putting their money into an untried invention on such terms.

STAINES RESERVOIRS COMMUNICATION WORKS.

The Fortis Green Reservoir.

Some of our readers may remember that the scheme of reservoirs at Staines devised by Messrs. Walter Hunter and R. E. Middleton, MM.Inst.C.E., and carried out by a Joint Committee composed of the Grand Junction, New River, and West Middlesex Water Companies, provided for the taking of the water by the respective Companies at works in the neighbourhood of Hampton. Those of the New River Company are situated at Kempton Park, whence a pumping main runs to Cricklewood, a distance of 13¼ miles. From this point the water is pumped through a 42-inch main a further distance of 3½ miles to the Fortis Green reservoir, from which it will afterwards be conveyed by gravitation in a 30-inch main to the distributing mains of the New River district at Hornsey. These works are now, of course, under the control of the Metropolitan Water Board. The Chief Engineer of the Board (Mr. W. B. Bryan, M.Inst.C.E.), being the President of the Junior Institution of Engineers, afforded the members an opportunity last Saturday afternoon of inspecting the reservoir, the capacity of which will be 10 million gallons, and its depth 17 feet. A central division wall, extending up to a level of 6 feet below the top-water line, will divide the reservoir below that level into two equal parts. The floor will be of concrete, the walls and piers of brickwork, and the roof of brick-arching, with concrete filling to the spandrils, and covered with asphalte. The structure rests upon a thick bed of London clay, and is made water-tight by a wall of clay puddle extending all round the outside of the walls, and carried well into the clay below. The whole will be covered with earth and be thoroughly well drained; and the top and slopes of the embankments will be turfed. The floors have a fall towards the southern end, along which a drain channel will be formed with an emptying pipe for clearing the reservoir when necessary. For convenience of sweeping out, there is in the floor between adjoining bays of arching a brick partition a few inches in height. To prevent mischief in case of over-pumping, an Appold overflow is provided. This ensures that as soon as the water has risen to a certain height above the lip of the overflow, the surplus shall be very quickly drawn down by syphon action to the proper level. The sides of the trenches that have been excavated for the main walls, and which are 21 feet in width, are supported by means of horizontal timbers, 11 in. by 3 in., held up in sets of four by vertical walings 12 in. by 6 in., kept apart by struts of like size. By this method the face of the clay is firmly retained in place, and has no likelihood of being affected by external moisture. Considerable lengths of 42-inch and 48-inch diameter brick culverts have to be constructed to carry the surface drainage which now traverses the site by means of ditches. The whole of the works were designed by Mr. Joseph Francis, M.Inst.C.E., who was Engineer of the New River Company, and are being constructed under his supervision.

A new recorder for carbon dioxide has been invented by Mr. A. Bayer, and is now being manufactured by Mr. Julius Pintsch, of Vienna. The gas is drawn from the flues by a water-jet air-pump, and is cooled before being measured for the actual test. The absorption of carbon dioxide is obtained by means of moistened caustic lime, and the residual gases are again cooled to a standard temperature before measuring, so as to ascertain the contraction in volume due to absorption. The results are recorded on a revolving drum by means of vertical lines exactly as in the Ados recorder, and samples can be tested at six-minute intervals. The measuring vessels of the apparatus are filled with paraffin oil, and all the parts are constructed of thin sheet metal. The only attention required is the charging of the box holding the caustic lime, and the changing of the sheet on the recording drum.

SOUTHERN DISTRICT GAS ASSOCIATION.

The Annual Meeting of the Association was held last Thursday, at the Hotel Cecil, Strand. There was a large attendance of members. The RETIRING PRESIDENT (Mr. F. W. Cross, of Lea Bridge) occupied the chair at the opening of the meeting.

CONFIRMATION OF MINUTES.

The minutes of the proceedings at the last meeting were taken as read, and confirmed.

ANNUAL REPORT OF THE COMMITTEE.

The PRESIDENT then submitted the annual report of the Committee, which, having been circulated, was taken as read.

The Committee in the report reviewed the work of the year, which embraced "events of unusual interest and importance." One of the interesting features of the year was the presentation, at the annual meeting on March 8, of a silver tea and coffee service to Mr. J. W. Helps, upon his retirement from the dual office of Hon. Secretary and Treasurer. Alluding to this interesting event, the report said:

> In making the presentation, the President, Mr. F. W. Cross, of Lea Bridge, referred in terms of warmest appreciation to the value of Mr. Helps's services to the Association during the long period of eighteen years, and claimed that his qualities of mind and heart had made him a power for good in the life of the Association, and had won for him the esteem and regard of the members.
>
> The President was followed by several members, who alike testified to the unique position and influence which Mr. Helps had occupied and exerted in the Councils of the Association during so many years.
>
> Mr. Helps, in a very felicitous reply, spoke of his love for the Association, of the benefits he had himself derived from membership, of his pleasure in the work he had been privileged to do for the Association, and of the kindness and friendship shown to him by members, and concluded with a heartfelt expression of thanks for the gift and for the sentiments which had prompted it.

After the references to the proceedings at the meetings, the report continued—

> The most important feature of the work of the Association during the past year has been the issue of the Committee's final report in connection with the Naphthalene Inquiry. The Committee are confident that members generally share their keen regret and disappointment at the premature termination, from lack of funds, of an investigation entered upon with the object of co-ordinating, by practical tests and experiments in gas-works, the widely divergent views, theories, and practice obtaining in connection with the naphthalene difficulty. The Committee believe their work has been the means of shedding further light upon this obscure problem; and they are confirmed in this view by the favourable reception which has been given to their final report, both at home and abroad. It is further a matter of great satisfaction to record that the work which the Southern Association has been obliged to relinquish is being continued by professional brethren in America and Germany, who have expressed their appreciation of the assistance which the information contained in the report will afford them in their further investigation.
>
> Ten names have been added to the roll of membership, five members have resigned, six have become disqualified, and two members—viz., Mr. J. Wadeson, an original member of the Association, and for 45 years Manager and Engineer of the Windsor Royal Gas Company, and Mr. C. B. West, of Vauxhall, have passed away; leaving a total of 167 members, as compared with 170 at the end of 1905.
>
> The balance standing to the credit of the Association at the commencement of the year was £105 19s. 3d. The receipts have amounted to £84 10s. 6d. and the expenditure to £95 8s. 9d.; leaving a balance of £95 1s. to carry forward. The usual copies of the Reports of the Gas Associations were presented to the members; and these absorbed a sum of £43.
>
> In concluding, the Committee feel that the best thanks of the members are due to the President and Hon. Secretary for their services to the Association during the past year.

The HON. SECRETARY (Mr. A. F. Browne, of Vauxhall) said he desired to call attention to the last paragraph but one of the report. It would be noticed that, at the beginning of 1906, the balance to the credit of the Association was £105 19s. 3d., whereas at the end of the year the balance had fallen to £95 1s. He should be sorry if it was thought that the Interim Secretary had been extravagant; and therefore he wished to state that practically the whole of the difference of £10 18s. 3d.—that was to say, £8 16s. 4d.—was expended in connection with the printing and issuing of the Naphthalene Report of the Association. The £8 16s. 4d. was so near the sum that constituted the difference, that he thought it unnecessary to say anything more.

Mr. T. BERRIDGE (Leamington) considered the report an excellent one. The work that had been done for the gas industry generally was altogether admirable.

Mr. J. TERRACE (Tottenham) seconded the motion, which was unanimously carried.

LOSSES TO THE GAS INDUSTRY—THE LATE MR. SUGG AND MR. YOUNG.

The PRESIDENT remarked that the members would have noticed in the report an allusion to the loss by death of two members—Mr. James Wadeson and Mr. C. B. West. But since the report was prepared, they had (the Association and the gas profession generally) suffered very much by the loss of two members of the profession—Mr. William Sugg and Mr. Young. He would ask Mr. Hunt to make a few remarks with reference to Mr. Sugg.

Mr. CHARLES HUNT (London) said it was his melancholy duty to give some expression to the feelings that he was sure animated them all with regard to the great loss the industry had sustained by the death of Mr. Sugg. He (Mr. Hunt) had been selected presumably for this office because, of all those present, he might perhaps lay claim to as long a term of years as anyone during which he had the honour and the pleasure of the acquaintance of Mr. Sugg; and, moreover, he felt he could appreciate as well as any present the great work that Mr. Sugg had done for the industry. Scarcely a movement had taken place in the development of gas in which Mr. Sugg did not play a prominent part. He (Mr. Hunt) need not refer to all the good work Mr. Sugg performed for the industry. He could only express the hope that, when the time arrived, each of them might be able to leave behind him at any rate a part of similar good work. He moved that a vote of condolence be passed to Mrs. Sugg and the family.

The motion was endorsed by the members silently rising in their places.

Mr. A. F. BROWNE said he was sure it was with feelings of the greatest regret that they learned recently of the death, after a protracted illness, of Mr. William Young, who had been such a good example, he might say, in two directions during the course of his long and useful life. As they knew, Mr. Young commenced his career in a gas-works; but he soon left gas-works and devoted his attention to the shale-oil industry. There he rapidly made his mark. Mr. Young had a mind so constituted that he must get to the bottom of things; and he applied himself so constantly to the theory as well as to the practice of the work in which he was engaged that his name became almost a household word not only in regard to the shale-oil industry, but in a great measure in connection with the gas industry. He (Mr. Browne) thought they would all agree that Mr. Young's writings and teachings were of the greatest value to the members of the gas profession; and he must personally say that there had been no writer upon the matters Mr. Young so ably discussed in whose work he had taken a greater and keener delight. Mr. Young was, he (Mr. Browne) was sure, looked up to with great respect by his colleagues in both industries; and he supposed that now Mr. Young had gone, they could say that the individual in this country who knew most about naphthalene had passed away. He seemed to have investigated the subject, and to have arrived at the true science of it many years before the great majority of gas engineers. And though there were others who had followed well in his footsteps, and carried on his work, the name of Young must always be more particularly associated with the naphthalene controversy in this country than that of any other man. It was not long ago, though Mr. Young had retired from work and was in ill-health, that he was good enough to assist one of their members—Mr. Thomas Glover, of Norwich—and Mr. Samuel Glover, of St. Helens, in the preparation of a paper and drawings on vertical retorts; and his knowledge of the shale-oil industry enabled him to make a very valuable contribution indeed to the subject. He had not, unfortunately, lived long enough to see the vertical retort he had especially favoured carried into practical operation in gas-works. He (Mr. Browne) merely alluded to this fact, because it showed how active Mr. Young's mind remained to the last. Every man engaged in the gas industry, he was sure, felt he had lost a personal friend, and one from whom he had received many lessons of the greatest value. He moved that a vote of condolence with the relatives of Mr. Young be passed by the members.

Dr. H. G. COLMAN (London) said he should like to associate himself with Mr. Browne's references to Mr. Young. To anybody who had been engaged on any question connected with naphthalene, his death must have the effect of a personal loss. He thought it would be universally agreed, as Mr. Browne had said, that to Mr. Young more than to any other single individual, the elucidation of the naphthalene problem was due. His papers, published in conjunction with Messrs. Samuel & Thomas Glover, laid clear the principles underlying the removal of naphthalene from gas; and the practical applications they brought about had formed the basis of all further work on the subject. Though perhaps Mr. Young's work on naphthalene was that which was most familiar to gas managers during the past ten years, it was really only a small side-issue of his work, which extended over an extraordinarily wide area—an area covering the large problems of distillation of both coal and shale, the fractional distillation of oils, the recovery of ammonia, and much else. It was granted to few men to have achieved so extensive a technical success over so wide an area as Mr. Young. When the history of the progress of the gas and allied industries during the last half-century came to be written, the name of William Young would hold a high position in the record. Mr. Young's papers were very numerous; and there was hardly one that did not contain much information of great value. He trusted that the proposed reprint of Mr. Young's papers would be carried into effect by the North British Association. This would be a fitting memorial to Mr. Young, and would stimulate others to follow in his footsteps in the work to which his life had been devoted.

The vote was passed by the members rising.

The New President.

The President said it was with regret that he had now to vacate the chair; but it was a pleasure to place in it the new President of the Association—Mr. Harold W. Woodall, of Bournemouth. He was sure they would derive great advantage from Mr. Woodall's presidency. Personally, he looked forward to the coming year with feelings of great pleasure. Mr. Woodall was now about to explain to them some of his work with the vertical retort. So far as he (Mr. Cross) was concerned, he was half-way between the horizontal and the vertical, but he had not yet reached the 45° of Mr. Love. He was sure the members would all join him in giving a hearty welcome to Mr. Woodall.

Mr. H. W. Woodall took the chair amid the cordial greetings of the members.

The President said it was his pleasant duty to propose a vote of thanks to the retiring President. The past session would always be an important one in the annals of the Association, in that it brought to a close the work of the Naphthalene Committee, and included other notable events, which were dealt with in the annual report. No Association could have had a better or more genial President than Mr. Cross had proved to be, nor one who had given himself more whole-heartedly to the work.

Mr. A. Dougall (Tunbridge Wells) seconded the motion, remarking that the members all knew how very heartily Mr. Cross had thrown himself into the work connected with the office of President. They were all much obliged to him for having presided so well over their deliberations; and they gladly thanked him for so doing.

The motion was cordially passed.

Mr. Cross, in reply, thanked the members heartily for this expression of their feelings for the services he had rendered. It had been to him a work of great pleasure. He was quite sure that he had received more instruction during his occupancy of the Chair than the members had received from him. It was a pleasure to do anything to further the work of the Association; and he trusted that the little he had done in the course of the year would bear fruit in the future.

Additions to the Roll.

Mr. G. W. Anderson, of Westminster, and Mr. G. M. Gill, of the Poplar station of the Commercial Gas Company, were unanimously elected to membership.

Alteration of Rule.

Rule 22 of the Association has hitherto read—"Each member of the Association shall be furnished annually by the Secretary with a copy of the regulations, and with a list of the names and residences of the members."

Mr. D. H. Helps (Reading) moved that the words "with a copy of the regulations and" be deleted. He explained that the Committee thought it unnecessary to go to the expense of sending out a copy of the regulations every year.

The President seconded the motion, which was unanimously carried.

The President then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—I thank you for the honour you have done me in electing me as your President for this year. While I appreciate that honour highly, I have frequently wondered lately whether I should not have been a much happier person had you selected some other and more worthy representative to fill the office which I am proud to occupy to-day. I cannot help feeling that you have taken some risk in electing as your President a man of limited experience, who is, by reason of the situation of his work, somewhat out of touch with the body of the industry; and I should look to the coming year with anxiety were it not for the fact that I know I can rely on the support of our able Honorary Secretary and of the Committee, and the hearty co-operation of the members, to enable me to maintain undiminished the prestige and dignity of our Association.

The Favoured Supplier of Electricity.

As a recruit from the body of electrical engineers, I have watched with much interest the growth and practice of our rival industry; and, while admiring much that they have done, I have at the same time found myself sometimes at issue with their methods, and at other times envying their freedom from legislative restrictions. In those days in the history of gas lighting when people thought the final stage of illumination had been reached, it was reasonable that Parliament, in granting exclusive rights of supply, should place such restrictions on companies entrusted with the distribution of gas as to prevent them exercising the privileges of a monopoly to the prejudice of the public. When electricity was brought into commercial use, the gas industry was firmly established; and Parliament apparently recognized that electricity was only an alternative illuminant, and left electric lighting companies comparatively untrammelled. They did not, however, relax the severe and complex regulations that governed gas companies; and it is only after years of arduous toil on the part of a few of the larger gas companies, and, of certain courageous and able gentlemen representing them, that these restrictions have in some degree been relaxed. Meanwhile, our electrical friends have availed themselves to the full of the wider powers granted them to cut into the business of the older industry. Free wiring, fanciful methods of charge, rebates and discounts on a scale never dreamt of by gas companies, have all been used in their turn in the effort to obtain consumers of electricity; and, however much we may disapprove of the methods adopted, it behoves gas engineers and managers to keep in touch with those methods, in order that we may be forearmed and prepared to meet them.

Certain electric light companies are introducing into their free-wiring agreements a clause which prohibits the consumer, in consideration of certain special terms, from using any other methods of lighting during his tenancy of the property. Where the installation is being placed in new property, this may be a reasonable precaution on the part of the electric light company. Where, however, the installation is to be fixed in property the tenant of which is already using a prepayment installation which a gas company has been at the expense of fixing, it is not fair trading for an electric light company to canvass that gas consumer with a view to obtaining his signature to an agreement which would, to all intents and purposes, remove from use during his tenancy the capital already invested by the gas company.

Restrictions to trade are undesirable; and it has been held by persons eminent in the law that there is nothing to prevent two or three gas companies joining together to test at law the power of the electric light companies to insert such a clause; and I trust that this will be done at an early date. Failing such action, it behoves all gas companies to look into their agreements, and see whether something cannot be introduced to protect them from such attacks as these—at any rate where prepayment installations are being put into new premises.

Our electrical friends are not restricted by testing clauses, and, subject only to the very proper reservation that "they shall not show any undue preference to any local authority, company, or person," they are free to charge in such manner and to allow such rebates or discounts as they may think fit.

Relaxation and the Revision of the Gas-Works Clauses Act.

Mainly owing to the efforts of Sir George Livesey, the London Gas Companies have secured immunity from the old sulphur clauses, and have been granted the use of a fair and reliable standard burner, with which latter the gas industry will always gratefully associate the name of Mr. Charles Carpenter.

It is everywhere recognized that the Gas-Works Clauses Acts are out of date and require revision; and it is desirable that the gas industry as a whole should be freed from many of the fetters imposed upon it by these Acts, and that all gas companies should be able to avail themselves of the advance of modern science and legislation. An individual gas company approaching Parliament to obtain relief from testing clauses, however oppressive and unjust, incurs heavy cost, and lays itself open to attack, and possible injury, over the whole field of its affairs. What is wanted now is permanent relief for the whole gas industry, in the shape of a new or amended Gas-Works Clauses Act. We have been told, and I think rightly, that in future the Institution of Gas Engineers should interest itself in all important movements affecting the welfare of the gas industry. Here, then, is a work which, carried to a successful conclusion, would amply justify the recent amalgamation of the two societies, and the high hopes with which we looked to the future of the united Institution. If the Council were to apply to all gas companies and municipalities owning gas-works for the funds that would be required if they took this matter in hand, I am certain that the necessary money would be subscribed; and they could look also for the hearty and unanimous assistance of the whole industry and this Association. The work is, however, urgent. Public opinion at the present moment seems to be in favour of granting greater freedom in gas manufacture; and the next session of Parliament should certainly see the new Bill introduced.

Supposition and Investigation.

While on this subject, I should like to allude to another direction in which I think the Institution could, and should, take action. At the present moment, there appears to be very little doubt in the minds of the public as to the economy of gas for lighting purposes *per se;* but our electrical rivals have put abroad very assiduously and thoroughly ideas as to the injurious effect of the products of combustion on personal health, fabrics, leather, and decorations generally; and, in consequence, many people are inclined to think that, putting one thing with another, there is not after all much difference in cost between the two illuminants. Nothing but the opinion of the very highest and best known scientists can permanently remove the impression fostered by these reports; and such opinion, backed up by the necessary tests, can only be obtained at heavy cost. It is only by united action that gas companies can afford to engage the very best experts; and here, again, is a field for the Institution.

I think that at one time many persons hoped that this kind of work might possibly be undertaken by the Gas Companies' Protection Association. Unfortunately, the funds available have not been sufficient to enable that Association to work on a very large scale; and while much has been accomplished that has been of value to the industry, the Institution is better fitted, by reason at once of the information and knowledge at its command and the facility with which it can raise funds, to undertake such work as I have referred to. I speak with the greatest deference as to the Association and the Presidents and Committees who have so

generously given their time and services to its work; but it seems to me that, in view of the excellent organization we now possess in the Institution of Gas Engineers, an arrangement might be made for that body to take over the funds and work of the Asso-tion. A larger amount of these funds would, I think, be available by this concentration, which added to the funds of the Institution would enable legislative and other work to be undertaken on a larger scale than can be contemplated by two separate organizations.

IN THE CAUSE OF LABOUR—EDUCATIONAL EFFORTS.

Much has been said at our meetings with regard to the training of the rising generation of gas engineers and managers, but little with regard to the education of our rank and file. Socialism, Trade Unionism, and modern legislation have, all in their way, tended to destroy those bonds of friendship and personal interest that used to exist between employer and employed. Probably they are all necessary, and have done good in their way; but, so far as my experience goes, the result up to the present has been destructive rather than constructive—a levelling-down and not a levelling-up.

We are constantly hearing of the heart-breaking carelessness, thoughtlessness, and slackness of the average man—of slipshod assistance, foolish inattention, and half-hearted work. These complaints are often justifiable; and the position is likely to become worse if employers of labour are content to swim with the tide rather than bestir themselves to meet the altered conditions of labour. I believe that eventually salvation will be found in profit-sharing. But if profit-sharing is to be permanently established, the benefits must be mutual, and result both in the prevention of strikes, and also a financial advantage to both employer and employed. The mass of employees must realize that the price of profit-sharing is individual responsibility, and must show, by intelligent, loyal, concentrated work, that the time has arrived for granting it.

In the meantime, the efforts of those who control enterprises where large numbers of men are employed should be united in the endeavour to make each individual man take an intelligent interest in his work—to think about and understand it. If only this condition can be arrived at, all the inability or unwillingness to concentrate upon a task will vanish, and we shall find the man enjoying his work, and developing at last into a genuine craftsman instead of the inert, apathetic individual with whom most employers are more or less well acquainted. Initiative must supply the place in the employee of responsibility in the manager; and, after all, the two conditions are very closely allied.

Dealing particularly with the case of employees of a gas company, I think that much good can be done by evening lectures, followed by discussions on subjects directly or indirectly connected with the work of the company. The discussion should be the most valuable part of the evening, though I am bound to admit that, so far as my own experience goes, it is most difficult to get men to express their views. Classes in "Gas Manufacture" and "Chemistry," held on the works, are very valuable; and now that there are evening extension classes held in the secondary schools of practically every town, the interest of the students in their work can be maintained from year to year, especially if the company will pay the fees of such students, and receive reports from the education authorities on their attendance and work.*

On the works, it is difficult to offer bonuses to the employees apart from profit-sharing; but, as an encouragement to intelligent co-operation, the "Suggestions-Box" which my Directors adopted, on my recommendation, rather more than two years ago has worked remarkably well. On each of the Company's works, an ordinary letter-box is fixed, in which employees can place any suggestions they may have to make on matters affecting the Company's interests. These suggestions are collected and tabulated every month; and at the end of the quarter a certain fixed sum is divided among those who have contributed suggestions. The whole of this sum is distributed irrespective of the quantity or quality of the suggestions received; and in apportioning the amounts, we endeavour to give at any rate a recognition of every suggestion, however small or unimportant it may be. At the end of the year, one single prize of £5 is granted for the best suggestion of the year.

The sources from which some of the suggestions come are most surprising; and I can unhesitatingly say that the increased interest which the men take in their work has been marked, and the Company have distinctly benefited by the scheme. I am pleased to say that at their last meeting my Directors felt that the sum allotted was not sufficient to provide a sufficient recognition of the suggestions received for the quarter ending Christmas last; and they allotted a further sum. The "Suggestions-Box" not only stimulates employees to show an increased interest in their work, but, as all the suggestions have to be described and frequently illustrated, the education of the competitors is further assisted in these most useful directions.

Wherever possible, I believe in paying for work at piecework rates, with a fixed minimum day's work and wage, and a sharing between employee and employed of the profit earned beyond the minimum; and I think that all profit-sharing schemes should be based on these lines—division being made in accordance with the net profit of the company in any year.

CONSIDERATION FOR THE FOREMAN.

While the difficulty of obtaining good workmen is marked, the question of foremen is also a serious one. No doubt the independence of the men and the somewhat aggressive attitude fostered by Trade Unionism and combination have contributed to make men unwilling to stand out from the crowd and accept the responsibility of controlling their fellow-workmen. In addition to this, however, the benefits offered to a foreman are often insufficient either to render the position very attractive in the first place, or to ensure his making every effort to maintain discipline and efficiency after he is appointed. The ideal foreman would make his mark in almost every branch of life; and when we consider the list of qualifications which he requires, it is perhaps no wonder that we rarely find him.

I think it is highly desirable that foremen should, where possible, be paid a bonus on the results obtained. Conditions vary in different works; but at Poole, where the works are in charge of one foreman on each shift, we have reduced the foremen's wages, and pay a bonus calculated on the following figures:—

Retort-House.

$$\frac{\text{Make per mouthpiece} \times \text{make per ton}}{1{,}000{,}000}$$

Carburetted Water-Gas Plant.

$$\frac{\text{Candles per gallon} \times 1000}{\text{Pounds of coke per 1000} \times \text{percentage of } CO_2}$$

Sulphate Plant.

Pounds of sulphate per ton of coal.

The bonus is shared by the whole of the shift foremen, so that all are penalized by the carelessness or negligence of one.

I do not think candle power should be included in any bonus scheme. Such definite illuminating power must be maintained on the works as to ensure that gas of the full illuminating power prescribed by Parliament is delivered at the testing-stations; and it would be unwise to permit the possibility of variations of illuminating power to be thought of. The work of a foreman is often very harassing. We all know that troubles never come singly; and when men are troublesome, heats are back, pipes stopped, condensers and washers choked with naphthalene, and the tar-main bursts, a foreman's lot is not a happy one. It seems to me that, if anyone is entitled to reduced hours of labour, it is the foreman; and, under any circumstances, arrangements should be made to ensure his having at any rate one day a week to himself, without having to work extra time to obtain it. If such points as these are studied, I think the position of foreman will be a sufficiently attractive one to excite keen competition among the men best qualified to fill it, and to provide an incentive to study and self-improvement.

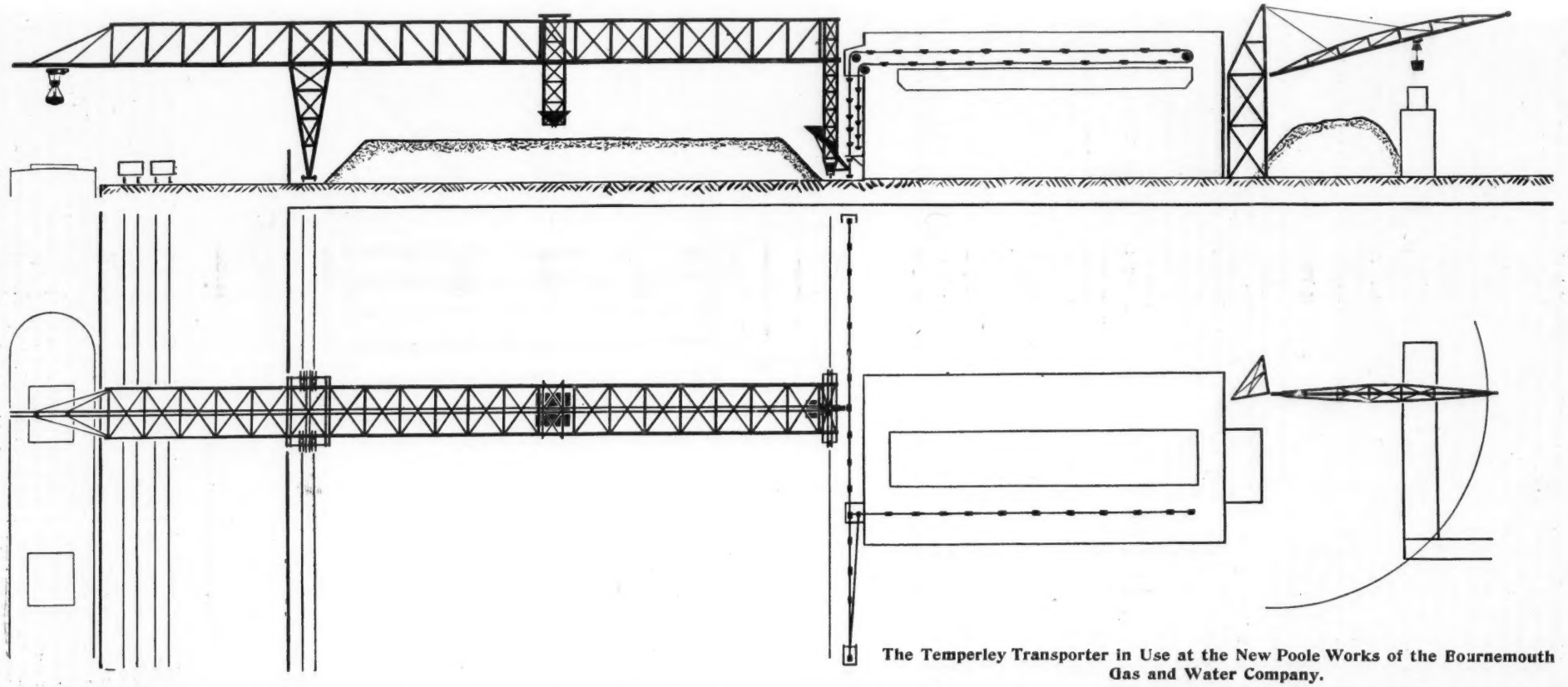
RECREATION OF THE MEN.

Now that shorter hours of work are the rule, the question of recreation is assuming an importance that it did not previously possess. It may not be a good thing for a man's thoughts to be directed too much to play; but it is a great deal better that he should indulge in some healthy and manly sport than that he should loaf about with nothing definite to do. Practically every form of amusement involves expense and organization; and a very slight amount of trouble on the part of the staff, and a comparatively small outlay by the company, can do much to provide healthy recreation, and ensure its being carried out in a wholesome manner. The Directors of the Bournemouth Company have always taken a great interest in the recreations of their employees, and have contributed to an athletic ground and provided a gymnasium and miniature shooting-range; and I am satisfied, from careful observation, that both the employees and indirectly the Company benefit by the healthy spirit introduced.

ROAD TRACTION AND COSTS.

Owing to the somewhat extensive district covered by my Company's operations, and the distance of their pumping-stations from the gas-works (we supply an area of 34 square miles with water and 52 square miles with gas), the question of haulage is an important one; and my Directors have from time to time authorized the purchase of various motors for this purpose. The ordinary steam motor waggon, using coke for fuel, and carrying about 4 tons, we find very useful for inter-works communication, and for the supply of some of our large consumers; but experience shows that, if we are to retain our popularity, it is not wise to permit such a motor to leave the public highway unless one is well acquainted with the surface and underground conditions of the route it is proposed to traverse. In greasy weather, also, care has to be taken with regard to the route traversed. The chief objection to the steam-waggon is its weight. Everything has to be cut down as far as possible so as to minimize this; and the wear and tear is considerable. Petrol-lorries, carrying about

* The President remarked, at this point of his address, that they started evening lectures and discussions at Bournemouth two years ago. They had the lecture first, then coffee and cakes, and discussions afterwards. The lectures were held every fortnight; and there was an average attendance of 90 men. They started a class in gas manufacture; and they sent from the works nineteen men for examination, eighteen of whom passed—three he believed with honours. Then in Bournemouth a chemistry class was started, and a course got up in workshop arithmetic, electricity, and drawing. The Company offered to pay the fees of the men attending these classes. Some 27 of the men accepted the offer, and had made an average attendance of 90 per cent. So they had every reason to anticipate that encouragement offered to the men would receive support from them.



The Temperley Transporter in Use at the New Poole Works of the Bournemouth Gas and Water Company.

30 cwt., are the most convenient for general work; but, owing to the nature of the roads over which ours travel, we have had considerable trouble with tyres. We have recently obtained spare wheels, so that the lorries may not be laid up while the wheels are re-tyred; and I have no doubt that the earning power of the lorries will be considerably increased by this means.

Where material such as coke or coal is required to be carried in bulk, the small steam-tractor, burning coke, is a handy and economical motor; and while our experience with this has only extended over a short period, the results obtained are very satisfactory. The tractor has no load to carry; and consequently the boiler and all the moving parts are much bigger than in the case of the steam-waggon.

	Cost.	Weight Unladen. Tons.	cwt.	qrs.	Load. Tons.	cwt.	Width of Back Tyres.
Steam-waggon	£585	4	4	4	4	0	9 inches
Petrol-lorry	595	2	19	3	1	10	7 ,,
,, ,,	595	2	19	3	1	10	7 ,,
Steam-tractor, two trailers.	593	6	10	0	6	0	12 ,,

The cost per ton-mile of working motor vehicles for the year 1906, including labour, stores used, replacements, and interest on capital, but not including depreciation, was—

	Cost per Ton-Mile.
Steam-waggon	11·09d.
No. 1 petrol-van	8·76
No. 2 ,, ,,	9·60

Against an average cost of 1s. 4d. per ton-mile for horse hire. The steam-tractor we have had running only some three months; but during that time it has hauled coke in bulk from our Poole works at an average cost of less than 4d. per ton-mile. This is a new tractor; and so there has been no cost of repairs.

There is one thing that should be borne in mind in connection with this question of motor traffic, and that is that, while it is desirable to write off the capital value of commercial motors in (say) seven or eight years, their value is not, as is the case of ordinary motor cars, in any way dependent on fashion; so that, if they are properly maintained, their useful life should be quite a long one.

THE NEW GAS-WORKS AT POOLE—TEMPERLEY TRANSPORTER AND ELECTRIC DRIVING.

I understand that some little interest has been expressed in the new gas-works at Poole and the electric driving adopted there; so perhaps a few remarks thereon may be of interest. My Company's land on Poole Quay is limited in extent; and in laying out the works it was necessary to utilize the whole of the ground to the best advantage from the point of view of economy of space. The quay is a public one, and the placing of cranes upon it is open to objection on more than one score. The Hunt gravity truck and similar arrangements for loading into store were unsatisfactory, as they did not utilize the ground space to the best advantage, and additional apparatus had to be arranged for taking coal from the store into the retort-house. After much consideration, I submitted a scheme to the Temperley Transporter Company and two other similar companies; and my Directors eventually accepted the tender of the Temperley Company. The transporter is 180 feet span between the rails of the travelling supports,

and has an overhang of 75 feet. It can be worked with the overhanging end lifted if desired. The main framework is 45 feet above the ground level, which leaves room to operate the grab over a storage of coal some 30 feet deep. The transporter can be traversed the whole width of the coal-store, and it spans the entire length; and there will be room for six weeks' stock of coal in front of each retort-house, with coal stored 16 feet deep. Coal can be taken from ship either in grabs or in skips. A weighing-machine is suspended from the main beam and can be traversed the whole length of the conveyor by means of an electric motor. A hopper is provided above the weighing-machine, so that the grab can travel direct from the ship's hold, drop the charge of coal into the machine hopper, and return at once for a fresh charge. Meanwhile, the machine comes to rest, the charge is weighed, dropped on to the stock heap, and the machine prepared to receive the fresh charge by the time the grab is back again. By this means there is no delay of the grab while the weighing machine comes to rest, and the speed of operation is much increased.

Where a fixed weighbridge on the main beam is used, considerable delay must take place. The grab then picks up its charge, attains its maximum acceleration, slows down, and comes to rest momentarily on the weighbridge, and then has to accelerate to its full speed again, and finally slow down and stop to discharge. Through the adoption of the travelling weighbridge, we are able to unload coal rapidly with one grab only. The best we have done from ship into store is 52 tons per hour; the best for a whole cargo is 800 tons in 22 hours, or 37 tons per hour. It must, however, be remembered that this is the first transporter built exactly on these lines; and the Temperley Company have at present several slight alterations in hand that will materially increase the speed of working.

ELECTRICITY GENERATED BY GAS-ENGINES.

A 70 H.P. electric motor is required for hoisting the grab, with a 37 H.P. motor for traversing it. A 26 H.P. motor is used to move the transporter across the coal-store; and a 2½ H.P. motor traverses the weighing-machine on the beam. The only power that would enable a speed of 50 tons per hour to be reached was electricity. We are using De Brouwer machinery in the retort-house, for which electric motors are required; so that, as practically three-fourths of the power required on the works would almost necessarily be operated by electricity, it seemed worth while to take this as our general power throughout the works, generating it by means of gas-engine dynamo plants. Up to the present we have not experienced any trouble from the electric installation at Poole; and it is working in an economical and satisfactory manner. The most convenient method of employing power must necessarily depend upon local conditions. At Poole it seemed advisable to utilize electricity generated primarily by gas-engines; and up to the present we have seen no reason to regret the decision. During the half year ending the 31st of December last, we generated 160,824 units of electricity at a cost per unit of 0·467d. for labour and 0·509d. for gas, or a total of 0·976d.

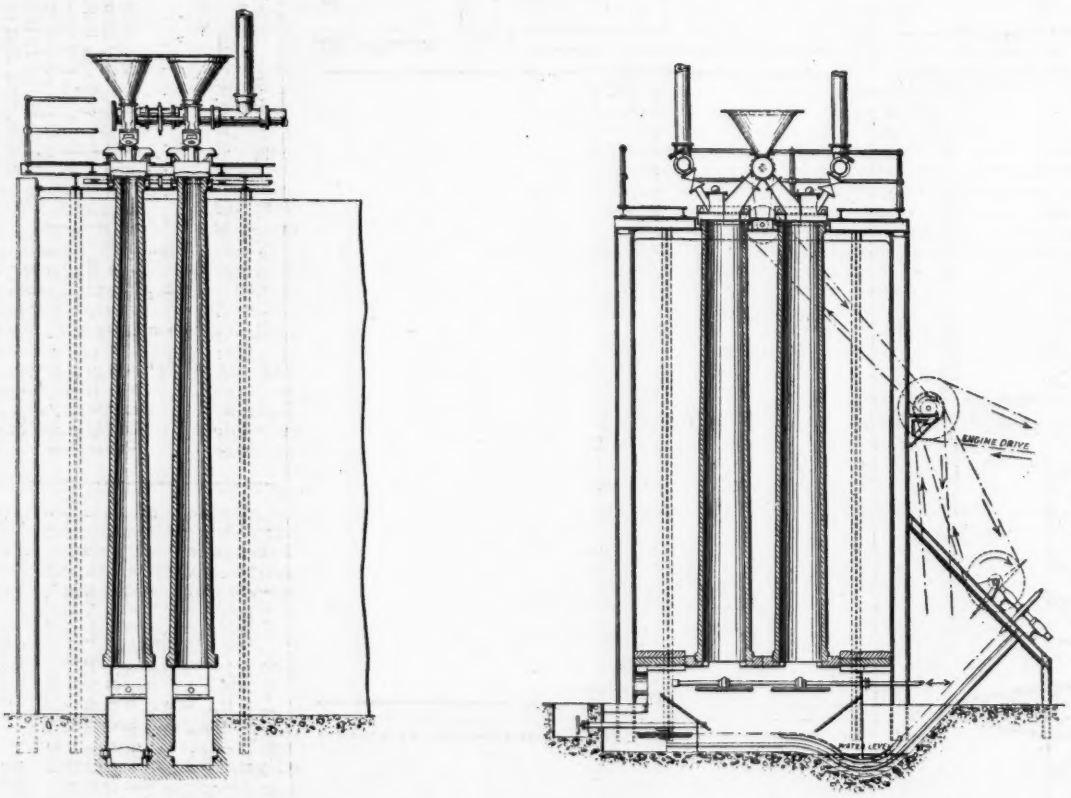
STEAM PRODUCTION.

The steam required by the water-gas plant and the sulphate plant is generated by two Stirling boilers, fired with breeze by means of underfeed stokers. The breeze is weighed into the boiler-house and the water metered. The cost of working is taken out every week; and we find that when the boilers are working at three-quarter load the evaporation is 6 62 lbs. of water per pound of fuel from and at a temperature of 212° Fahr. This is only an ordinary working figure, and not a special test one; and it seems to point to an economical combination of units.

CONTINUOUS CARBONIZING IN VERTICAL RETORTS AT BOURNEMOUTH.

I should not like to conclude my address without a few words on the subject of continuous carbonization in vertical retorts. The present plant at Bournemouth has only been in operation for a short time; but I feel that the description of a mechanical process by means of which continuous carbonization has been attained is likely to be of interest to the Association, though the arrangements in connection with the measuring of coal, gas, and residuals are not yet sufficiently in order to enable me to deal to-day with working results.

I have here a small model of the plant with which we started in 1903; and the principle of the process will be readily understood



Longitudinal Section. Cross Section.

Woodall-Duckham Vertical Retorts.

from it. The system primarily consists of a substantially vertical retort, tapered from the top to the bottom, with a conveyor for removing the coke from the bottom, and a feeding device which allows the required quantity of coal to enter at the top. The whole is so formed and actuated that the amount of coal carbonized is regulated by the rate at which the conveyor removes the coke from the bottom of the retort; the charge of coal and coke in the retort forming the intermediary between the conveyor and the feeding device, and allowing only an amount of coal to enter the retort proportionate to the coke removed by the conveyor. A shoot connects the feeding device with the retort; and the coal follows down this shoot on to the charge in the retort as the coke descends. Thus there is usually a space at the top of the shoot just before the feeding device is in a position to deliver coal into it. The feeding device is so actuated that even after filling up the space in the shoot, there is always coal left in it; but the special formation of the feeding device that is employed prevents this excess of coal from putting an injurious pressure on the charge or the retort. By the combination of the coke-removing conveyor, the charge of coal and coke in the retort, and the special form and working of the feeding device, constant and continuous conditions of carbonization are ensured. The retorts are rendered gas-tight while carbonizing, by providing the feeding device with gas-tight working faces, and by extracting the coke

through a water-seal. The coke as it descends from the retort into the water-seal is quenched, and the steam formed ascends the retort, and is converted into water gas; thus making use of the heat in the coke.

This single retort was worked with satisfactory results for a considerable period, and was followed by a setting of four vertical retorts worked on exactly the same principle. The results obtained from this setting were such that my Directors decided to erect a considerable installation at the Bourne Valley station.

I have here a diagram of the process as at work at Bournemouth at present, and as it will be shortly both in London and Liverpool. The settings are each composed of four vertical retorts differing chiefly from the old settings in that, instead of removing the coke directly from the retorts by a conveyor, a reciprocating discharging device has been introduced which regulates the rate of carbonization, and discharges the coke on to a quick-running conveyor, which passes through a water-seal and discharges the coke outside the setting. The retorts are heated most highly at the top; the combustion chamber being at the top of the setting. The flue gases are drawn down to the bottom, whence they pass into the regenerators. Demonstration is often more valuable than description, and as the Association have accepted the invitation of my Directors to visit their works in the summer, I can look forward with pleasure to showing you the vertical retorts in operation at an early date.

In conclusion, I may say it is pleasant to find each year bringing renewed prosperity to the gas industry, despite competition in every form; and while the immediate future is not without its anxieties, we can face them cheerfully, knowing that we have ample resources to weather any passing storm.

At the close of the address, questions were asked regarding the vertical retorts by Mr. S. Y. Shoubridge, Mr. J. Tysoe, Mr. D. H. Helps, and Mr. A. F. Browne.

The PRESIDENT, in reply, stated that they worked the charge through the retort in about ten hours. They had not, however, yet been working long enough to know the best time to occupy in working a charge through. One point he might mention in connection with this was that to bake coke for ten hours was not a desirable thing—even with horizontal retorts. With their vertical retorts, they had a certain amount of steam passing in at the bottom, and they found the coke there was almost black, showing that the action of the steam cooled the coke, and prevented any injurious baking action there. The bottom of the retort was kept tight by the plate forming the water seal. The coke was pushed away by an ordinary push-plate conveyor. The diagram showed the two guide-rails which formed the roller path. Up to the present, they had not got the figures sufficiently together to give detailed results of working. Regarding carbonic acid in the gas, they had never exceeded 2·5 per cent., but had not yet analyzed the gas to ascertain the quantity of carbon monoxide in it. Any illuminating power that was wanted could be obtained; it was merely a question of regulating the speed at which the charge was run in. The pressure at the bottom of the retort was practically identical with what they were working at at the top. They had endeavoured to keep a perfectly level gauge. He had seen a pressure of ½ inch without the faintest sign of leakage anywhere. As to the size of the coke, sometimes it was big; and sometimes small. It worked out to about the average of the coke in ordinary working, but, if anything, was rather larger. It was a very hard coke. The steam was produced as the hot charge met the water; but they were not at all anxious to generate any considerable amount of steam.

Mr. NORTON H. HUMPHRYS (Salisbury) then proposed a vote of thanks to the President for his interesting and instructive address. Mr. Woodall had introduced himself to them as a recruit from the electrical industry; and he was sure the gas industry might congratulate itself upon the strength of the recruit. The electrical industry had lost a powerful individuality; and the gas industry had had the privilege of gaining one. Mr. Woodall was a gentleman who was able to appreciate the numerous problems with which gas managers had to deal at the present time. They were never more numerous; and they seemed to increase every year. And the President not only appreciated them, but he found practical ways of dealing with them. The members were looking forward with pleasure, he was sure, to the privilege of seeing the arrangement of vertical retorts and coal transport at Bournemouth.

Mr. JAMES W. HELPS (Croydon) said that he had known Mr. Woodall practically all his life. He knew him when he was studying to gain experience in his mechanical work; and he knew him when working as an electrical engineer. He (as Mr. Humphrys had done) congratulated himself and the industry when he heard that Mr. Woodall was going to forsake the perhaps more fashionable pursuit of electricity for the more commonplace but, he thought, more reliable industry with which those present were all connected. He knew when Mr. Woodall came into the gas profession that he would introduce many novelties and original ideas in connection with gas-works practice, and he left the members to decide whether or not that view was a correct one. He thought that anyone who had listened to Mr. Woodall that day would acknowledge that he was a man of many ideas, and one who had the pluck and courage to carry them into practical effect, and to prove to his Directors that, in allowing him to do so, they had done something that must redound to the prosperity of the undertaking of which they had charge and of the industry generally. The members looked forward to going to Bournemouth to see the practical proof of what they had heard about that day; and they were all anticipating an extremely profitable year under Mr. Woodall's presidency.

The motion was carried with applause.

The PRESIDENT acknowledged the kind words of the mover and seconder. He felt sure that nothing but kindness and genuine feeling prompted the remarks and their endorsement by the members. However little he deserved the kind words and thanks, he appreciated them very sincerely.

DISTRICT COUNCILLOR.

The HON. SECRETARY announced that the Committee had nominated the President as district representative on the Council of the Institution of Gas Engineers for 1907-8.

This concluded the business proceedings.

THE ANNUAL DINNER.

There was time for a little social intercourse before dinner; but the centre of interest in the interval was a model of the vertical retort, with means for operating by hand the charging device and the discharging conveyor. The President and Mr. Duckham were bombarded with questions as to details, which they answered freely so long as they did not pass the demarcation between construction and result. While one constructional detail was found to be faulty, one detail in method deficient, Mr. Woodall has consistently maintained that—the operations from charging to discharging being so interlinked—results must thereby be vitiated; and till every operation obtains its proper relationship to the others, reliable figures are out of the question.

At the dinner, among others attending, were the President of the Institution of Gas Engineers (Mr. Charles Hunt), Mr. Corbet Woodall, Mr. H. E. Jones, and Mr. Hubert Pooley, of Stafford, the President of the Midland Association. The toasts were of the usual order; the speeches exceptionally good. An excellent programme of music and song also gave much pleasure. In the course of the speeches, there were references to the special work in which the Institution of Gas Engineers are aspiring to engage. A few of the remarks are worth putting on record. Mr. Corbet Woodall said if the work undertaken by the Institution was likely to be productive of good, there would be no lack of funds to carry it on. The London Gas Companies were quite capable of carrying on investigations themselves; and they were doing so at their own cost. But he was sure there was patriotism among, and *camaraderie* enough between, the gas companies and corporations of this country to cause them to join heartily in any such work for the benefit of the whole industry. Later, the President of the Institution (Mr. Hunt) remarked that he was glad to have from Mr. Corbet Woodall the assurance that help would be forthcoming whenever the need for it arose—whenever it was shown that the Institution were undertaking a really useful work in the matter of investigation. One subject had been taken in hand. They had undertaken to investigate the question of carbonization. He thought it would be agreed that there was no more important subject before the gas industry at the present time, or one that the Institution could more usefully investigate. The President of the Association had done much towards elucidating this important problem; but the Council of the Institution wished to bring to a focus all that had been done, and all that was being done, to raise the level of carbonization. He hoped the Institution would receive, during the next few weeks, an important contribution from the great Company of which Mr. Corbet Woodall was the respected Governor.

PROFESSOR GRAY ON FLAME TEMPERATURES.

In the "JOURNAL" for the 5th inst. (p. 686), we noticed briefly a lecture on "Flame Temperatures," delivered by Dr. THOMAS GRAY, of the Glasgow and West of Scotland Technical College, before the members of the Western District Section of the Scottish Junior Gas Association, on the preceding Saturday. It was mentioned that Dr. Gray was preparing for publication a summary of his lecture; and this has now come to hand.

Professor Gray said the subjects of "Flame Temperatures" and "The Atmospheric Burner" had been so ably dealt with by Professors Smithells and Lewes in their lectures to the Institution of Gas Engineers, that it would be difficult to present any new information. But after having considered these lectures—with which he supposed the members were familiar—he thought it might be interesting if he were to explain the method of calculating the maximum temperatures attainable by the combustion of various gases in air. He referred to the lecture on "Flame Temperature and its Practical Aspects" (*ante*, p. 217), in which the authors of text-books generally were subjected to severe criticism for their failure to give the reader useful information on practical subjects; the lecturer directing his remarks more particularly to a well-known text-book on Physics, in which he had searched in vain for instruction on the method of calculating the flame temperatures of gases from chemical and thermo-chemical data. Dr. Gray next called the attention of his audience to a book entitled "Industrial Furnaces," by Damour, translated by

Queneau, in which such calculations are very fully explained, and said that he would draw freely from this source for the purposes of his lecture. He then demonstrated the Junkers gas-calorimeter, and referred shortly to the method of determining calorific values. He reminded members that the water which is formed by the combustion of hydrogen and hydrocarbons leaves the flame in the form of vapour; whereas in the calorimeter it is condensed to liquid, giving up its latent heat in the process. A deduction must, therefore, be made from the values determined experimentally, to give the net calorific values, which represent the number of heat units generated by the combustion of unit volumes of the gases, when the water is retained in the form of vapour. Assuming all the heat of combustion to be utilized in raising the temperature of the products of combustion—none being lost by radiation or otherwise—it was easy to calculate the temperature which would result if the volume and specific heat, or thermal capacity, of the products were known. In the earlier calculations, the specific heats of the various gases at high temperatures were assumed to have the values which had been determined experimentally between 0° C. and 100° C., with the consequence that the calculated flame temperatures greatly exceeded those attainable in practice. But later investigation had proved that the specific heats of gases increase with rise of temperature; and this observation explained, to some extent, the differences between calculated and observed temperatures.

The lecturer here directed attention to some tables of figures which had been distributed, and which are reproduced below.

TABLE I.—*Molecular Calorific Values.*

Substance.	Molecular Formula.	Molecular Weight.	Net Calorific Value per Gramme Molecule.
Hydrogen . . .	H_2	2	58·2 calories
Methane . . .	CH_4	16	195·2 ,,
Ethylene . . .	C_2H_4	28	319·6 ,,
Benzene . . .	C_6H_6	78	753·6 ,,
Carbon monoxide	CO	28	68·2 ,,

TABLE II.—*Volumes of Oxygen necessary for Complete Combustion of One Volume of Gas and Volumes of Products of Combustion.*

Gas.	Volumes of Oxygen for 1 Volume of Gas.	Volumes of Products of Combustion from 1 Volume of Gas.	
		CO_2	H_2O
Hydrogen	0·5	..	1
Methane	2·0	1	2
Ethylene	3·0	2	2
Benzene	7·5	6	3
Carbon monoxide. .	0·5	1	..

Note.—Air contains by volume: Oxygen, 21 per cent.; nitrogen, 79 per cent. One volume of oxygen is therefore accompanied by $\frac{79}{21}$ volumes, equal to nearly 4 volumes of nitrogen. The volume of air necessary for combustion is: Volume of oxygen $\times \frac{100}{21}$, or approximately five times the volume of oxygen.

TABLE III.

[From "Industrial Furnaces," by Damour.]

Thermal Capacities per Gramme Molecular Volume in Calories.

Temp.	O_2, N_2, H_2, CO.	H_2O.	CO_2.	CH_4.
1000° C.	7·43	10·98	12·22	15·77
1200°	9·05	13 87	15·55	20·37
1400°	10·73	17·00	19·18	25·44
1600°	12·46	20·35	23·10	30·99
1800°	14·21	23·86	27·21	36·86
2000°	16·05	27·76	31·84	43·55
2200°	17·91	31·82	36·65	50·54
2400°	19·84	36·10	41·76	58·02
2600°	21·81	40·62	47·16	66·04
2800°	23·82	45·64	52·84	74·42
3000°	25·89	50·64	58·86	83·34

The lecturer went on to say that the calorific value of a gas was usually expressed in British thermal units per cubic foot, or in calories per cubic metre, but that a statement in the form of "molecular heat of combustion" was for some purposes more convenient. It was then possible to attach the number of heat units liberated during combustion to the chemical equation which represents the reaction, and to read directly from the equation the weights and the volumes of the gases. Thus the equation $H_2 + O = H_2O +$ (58·2 calories) conveys the information that 2 grammes of hydrogen developed sufficient heat in combustion to raise the temperature of 58·2 kilogrammes of water 1° C. He further explained that the molecular weight, expressed in grammes (see third column of Table I.), of each of the gases occupied the same volume—viz., 22·32 litres, at 0°C. and 760 mm.; and that this quantity would be referred to as the "gramme molecular volume," or, more simply, "molecular volume." The equation therefore also shows that the molecular volume of hydrogen (22·32 litres) generated 58·2 calories during combustion.

As the quantities of the various gases represented by the formulæ H_2, CH_4, C_2H_4, C_6H_6, CO, O_2, N_2, and H_2O (vapour), all occupied the same volume, the amount of oxygen necessary for combustion and the volumes of the products given in Table II. could be read directly from the equations—

$$H_2+O=H_2O \quad CH_4+2O_2=CO_2+2H_2O \quad C_2H_4+3O_2=2CO_2+2H_2O$$
$$C_6H_6+15O=6CO_2+3H_2O \quad CO+O=CO_2$$

Note: $O = \frac{1}{2} O_2 = \frac{1}{2}$ molecular volume.

In explanation of Table III., which was calculated from the results of the experiments of Mallard and Le Chatelier, the lecturer stated that the figures showed the number of calories necessary to raise the temperature of the molecular volume of each of the gases from 0°C. to the temperatures given in the first column.

The method of calculating the maximum temperature which can be produced by burning a gas with air, both being used cold, was illustrated with the help of the following examples:—

Hydrogen Burning with the Theoretical Quantity of Air.

Equation: $H_2 + O = H_2O$ (+ 58·2 cal.).

1 mol. vol. of hydrogen unites with $\frac{1}{2}$ mol. vol. of oxygen, producing 1 mol. vol. of water vapour.

$\frac{1}{2}$ mol. vol. of oxygen is accompanied in air by 2 mol. vols. of nitrogen.

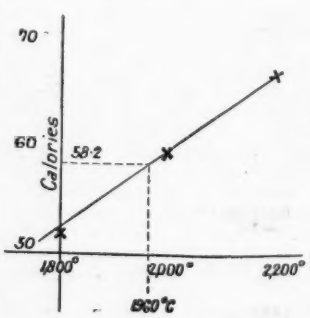
The products of combustion of 1 mol. vol. of hydrogen are therefore: 1 mol. vol. of water vapour, and 2 mol. vols. of nitrogen. These quantities are heated to the temperature T by the heat of combustion—viz., 58·2 calories = T is found with the help of Table III., thus:

To heat—

1 mol. vol. of water vapour from 0° to 1800° C. .	23·86 calories required.
2 ,, ,, nitrogen ,, ,, ,, ,, .	28·42 ,, ,,
Products of combustion of one mol. vol. H_2 .	52·28 calories required.

The corresponding values for 2000° C. and 2200° C. are found in the same way. These are stated below.

Products of Combustion from 1 Mol. Vol. of Hydrogen.	Thermal Capacities.		
	1800° C.	2000° C.	2200° C.
1 molecular volume water vapour .	23·86	27·76	31·82
2 ,, volumes nitrogen . .	28·42	32·10	35·82
Total	52·28	59·86	67·64



The lecturer said it was evident, from an inspection of these figures, that the heat of combustion, 58·2 calories, was sufficient to raise the products of combustion to a temperature not far short of 2000° C. The exact value of T was found from the accompanying diagram, representing as it does the relation between the temperatures and thermal capacities (= 1960° C., approximately).

Coal Gas with Theoretical Quantity of Air.

Composition of Gas.	Calorific Value per 100 Mol. Vols., Calculated from Figures in Table I.
H_2 . 54	54 × 58·2 = 3142·8 calories
CH_4 . 34	34 × 195·2 = 6636·8 ,,
C_2H_4 . 3	3 × 319·6 = 958·8 ,,
C_6H_6 . 1	1 × 753·6 = 753·6 ,,
CO . . 6	6 × 68·2 = 409·2 ,,

100 molecular volumes evolve on combustion 11,901·2 calories.

Therefore 1 molecular volume develops on combustion 119 calories.

Products of Combustion (*see Table* II.).

Composition of Gas.	Oxygen Required.	Products from 100 Molecular Volumes.		
		CO_2	H_2O	N_2
H_2 54	27·0	..	54	..
CH_4 34	68·0	34	68	..
C_2H_4 3	9·0	6	6	..
C_6H_6 1	7·5	6	3	..
CO 6	3·0	6	..	..
100	114·5	52	131	..

Nitrogen from air . . . 114·5 × 4 = 458 vols.

Products from Gas.

	From 100 Mol. Vols.	From 1 Mol. Vol.
CO_2	52 vols. ..	0·52
H_2O	131 ,, ..	1·31
N_2	458 ,, ..	4·58

Products of Combustion per 1 Molecular Volume.		Thermal Capacities. 1800° C.	2000° C.	2200° C.
H_2O	1·31 molecular volumes	31·25	36·36	41·68
CO_2	0·52 ,, ,,	14·15	16·56	19·06
N_2	4·58 ,, ,,	65·08	73·51	82·02
Total		110·48	126·43	142·76

The heat of combustion of 1 molecular volume is 119 calories, corresponding with T = 1910° C.

Same Coal Gas Burning with 10 per Cent. Excess of Air.

The air necessary for the combustion of 100 molecular volumes of gas is five times the volume of oxygen = 114·5 × 5 = 572·5 molecular volumes; 1 volume of gas requires 5·72 volumes of air; and 10 per cent. excess is 0·57 volumes.

Products of Combustion. Molecular Volumes.		Thermal Capacities. 1800° C.	2000° C.
H_2O	1·31	31·25	36·36
CO_2	0·52	14·15	16·56
N_2	4·58	65·08	73·51
Air	0·57	8·10	9·15
Total		118·58	135·58

One molecular volume of gas gives 119 calories, which would raise the temperature of the products of combustion to 1805° C.

Table showing Maximum Temperatures attainable by the Combustion of Gases in Dry Air.

Gas.	Temperature. Deg. C.
Hydrogen	1960
Methane	1850
Carbon monoxide	2100
Water gas, theoretical (CO, 50; H_2, 50)	2030
Do., industrial (H, 51; CH_4, 0·5; CO, 42; CO_2, 4; N_2, 2·5)	2010
Coal gas of composition already given	1910
Do., with 10 per cent. excess of air	1805

The lecturer called attention to the fact that a high calorific value did not necessarily indicate a high flame temperature. He said it was well known that blue water gas, which had only about half the calorific value of coal gas, gives a hotter flame; the explanation being that the volume of the products of combustion from the unit volume of coal gas is much greater than in the case of water gas, on account of the larger volume of air necessary for combustion. The inert nitrogen in this larger volume of air was raised to the temperature of the flame; thus absorbing a considerable proportion of the heat. He added that the temperatures given in the table could not be attained in practice, without pre-heating the air or gas, for two reasons—first, there was always a loss of heat by radiation; and, secondly, the temperature was further limited by the partial dissociation of the products. The radiation losses in the ordinary bunsen flame varied greatly with the method of burning. If insufficiently aërated, the gases took from the surrounding atmosphere a large proportion of the air necessary for combustion, and the gases had to travel some distance before the required amount of oxygen had diffused into the flame, which consequently had a comparatively large area; whereas with more complete aëration a smaller, hotter flame resulted. The minimum size of flame, and consequently the maximum temperature, would be obtained by mixing the gas and air thoroughly in the proportions which would be necessary to ensure complete combustion, and causing the mixture to issue from the burner with sufficient velocity to prevent the flame striking-back.

The lecturer here demonstrated the method of measuring flame temperatures by means of a thermo-electric couple attached to a mirror galvanometer, and showed, by the movement of the spot of light, the varying temperatures of different parts of the ordinary bunsen flame. He then illustrated the shrinkage of the flame on increasing the air supply, and the consequent increase of temperature. The uniformly high temperature of the Mecker burner was also demonstrated. Having emphasized the fact that the flame temperature of a gas varies with the method of burning it, Dr. Gray referred to the results of the measurements of the temperature of the bunsen flame which were collected and published by Professor Smithells in his lecture to the Institution of Gas Engineers.* These results varied from 1630° C. to 1870° C. He reminded the audience that a fine platinum wire could be fused in a coal gas blowpipe flame, and that the maximum temperature attainable practically was consequently higher than the estimated melting-point of platinum—viz., 1780° C. He expressed the view that the discrepancies between the observed and calculated values were not greater than might be expected considering (1) the difficulty of measuring the exact temperature of a thin sheath of glowing gas, (2) the loss of heat due to radiation, and (3) the effect of dissociation. In connection with the last-named cause, he quoted Deville's work on the dissociation of water vapour, and gave the following figures, due to Le Chatelier, illustrating the dissociation of carbon dioxide:—

Degree of Dissociation.

Temperature.	Press. = 0·1 Atmos.	Press. = 1 Atmos.
1500° C.	1·7 per cent.	0·8 per cent.
2000° C.	8·0 ,,	4·0 ,,

Having explained how dissociation sets a limit to the temperature, the lecturer said its influence appeared to be very much less than was commonly supposed to be the case, if Le Chatelier's figures were correct.

* See "JOURNAL," Vol. XC., p. 685.

In conclusion, Dr. Gray pointed out that great reliance should not be placed on the accuracy of the calculated figures, on account of the uncertainty regarding the values of the thermal capacities at high temperatures; but he thought the figures would interest the members as an indication of what might be expected from gases of different compositions.

Discussion.

The PRESIDENT (Mr. James M'Leod) intimated that Professor Gray had very kindly agreed to allow the members to ask him any questions.

Mr. ALEX. WILSON (Glasgow) thought it would be out of place to attempt any criticism upon the excellent lecture to which they had listened; but he would just like to say how much he was indebted to Professor Gray for the very clear exposition of his subject which he had given. The language that had been used had been so simple that what he wanted them to understand must have come home to all. He thought the Council of the Association deserved credit in arranging for such a lecture. They had set an excellent precedent; and he hoped that next year the members would be favoured in a similar way. He begged to thank Professor Gray for the manner in which he had set forth his subject.

Mr. W. WILSON (Falkirk) said he had learned a great deal from the lecture; and he could only echo what had been said with regard to the simplicity of the language used by the lecturer.

Mr. H. O'CONNOR (Edinburgh) reminded the members of the great interest this particular subject had at the present time, in connection with the use of the incandescent mantle. It was the question of flame temperature far more than that of the calorific value of gas they had to think of; and it was the flame temperature which, in the high-pressure burners, gave off the higher quantity of light. Professor Gray had shown very clearly the rise of temperature when the flame was reduced in length by means of the increased pressure of air. They would have observed on the scale, in the experiment, that he obtained an increased temperature. This was what was found with the incandescent mantle in the high-pressure systems, because much greater heat was given to the mantle, and consequently they had a larger amount of light.

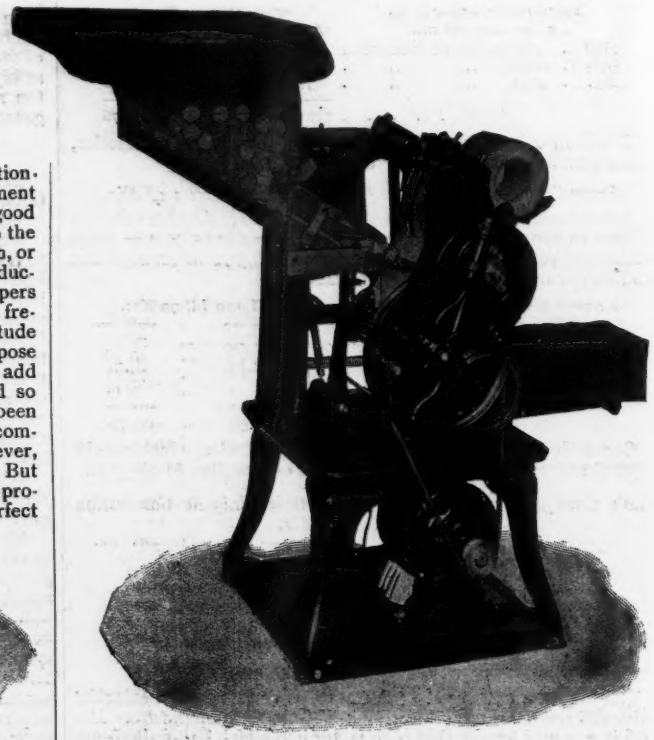
Mr. P. M'DOUGALL (Helensburgh) asked the lecturer what he considered the best way of producing a flame of maximum temperature at minimum cost.

The PRESIDENT added his thanks to those which had been offered. He said the subject was an extremely complex one; and Professor Gray had dealt with it, as they might have expected, in a very lucid manner. Its practical bearing had, of course, been brought out. He might just emphasize what had been said, by remarking that the question with the gas manufacturer now-a-days was to get as high a temperature as possible in his retorts, because this meant a higher percentage of hydrogen in the finished gas, and therefore a shorter flame, and consequently a higher temperature in the flame. In other words, gas would, in these circumstances, contain a greater percentage of hydrogen, less air was required for its combustion, and a greater flame temperature resulted.

Professor GRAY said, with reference to Mr. M'Dougall's question, that it was a point he was hardly qualified to speak upon, and possibly, if he were, he could hardly do so in the short time left. He could only say that the President had largely anticipated his reply. In order to have a gas of high flame temperature, the figures which he had given indicated that they must have a gas which used a comparatively small quantity of air. They must have the flame reduced in size, so that it would be intensely hot—a fierce flame. This was done, first of all, by regulating the quantity of air, and seeing that the gas and air were thoroughly mixed before being burned. Theoretically, the most intensely hot flame would be found by mixing the gas in the proportion necessary for complete ignition. Of course, in this case, the gas would explode, and the explosion would travel back and cause difficulty. They must prevent this by heating the gas and air. This was what was arrived at in the various systems of high-pressure gas lighting, in which the air, in certain proportions, was so mixed with the gas as to produce a small flame, which gave a high temperature on account of the area of combustion being reduced. This, so far as it could be stated in general terms, was his reply to Mr. M'Dougall's question. It only remained for him to thank the members for their cordial reception of his lecture, and also the gentlemen who had spoken, for the kind way in which they had referred to his exposition of the subject. He was afraid their thanks were somewhat undeserved, because he had not gone to all the trouble he might have done in converting the metric units into British thermal units. But it did not matter whether they dealt with molecular volume or cubic feet. They were relative terms, and they could all, by very simple arithmetic, convert any of the metric units into British thermal units.

Informal Meeting of Scottish Gas Managers.—Circulars have been issued by Mr. W. B. M'Lusky, of Perth, the Convener of the Informal Meeting of Scottish Gas Managers, intimating that the annual gathering is to be held in the Grand Hotel, Charing Cross, Glasgow, on Wednesday, the 3rd prox. The President for the year is Mr. J. W. Napier, of Alloa, who is to deliver his address at 1.30 p.m., after which there will be a discussion, followed by a dinner.

MECHANICAL COIN HANDLING.



THE ever-growing use of the prepayment gas-meter system and the consequent ever-increasing collection of pence and shillings, have produced an additional volume of work that has, in most gas undertakings, necessitated the creation of a new department, with its special staff and accommodation. The total half-yearly or yearly collections from the prepayment meters are now mostly spoken of in thousands of pounds, and a good many thousands in certain instances; and calculations as to the tons of coppers that have to be handled in a week, in a month, or in six months now supply quite a popular "tit-bit" for production at the periodical meetings of shareholders. All these coppers or shillings require counting. It is a heavy task, requiring frequently several hands, expedition, and yet the utmost exactitude in both counting and bagging. The hands needed for the purpose (and the persons employed must be responsible and reliable) add to the expenses involved by the prepayment system; and so much has this been felt that the reduction of labour has been attempted by the invention of devices to automatically accomplish the counting. To the best of our knowledge, however, these inventions have only partially eliminated hand work. But now an inventive genius, after five years' experimenting, has produced a machine which will count and wrap coin with perfect

accuracy, and as rapidly, we should say, as five or six expert cashiers.

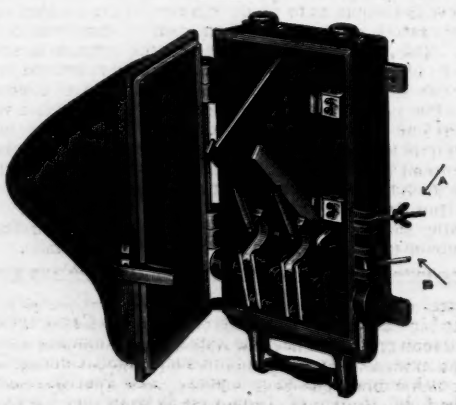
This device is to be seen at the offices of the British Coin Handling Machine Company, Limited, of No. 6 and 7, King William Street, E.C.; and the machine with which demonstration is made is arranged to count shillings, and wrap them up into rolls of fifty. Of course, the machine is constructed for any coin, and for any convenient numbers.

From a platform with raised edges at the top of the machine, the coins are fed into operating parts through a shoot, at the end of which they are assembled into line. Each coin, as it passes into line, is automatically counted, and the number of coins in line is shown on a dial. As the fiftieth coin (and if there are not fifty coins, not before the fiftieth one is supplied) falls into position, the roll of coins is gripped automatically, carried under a roll of strong paper and wound securely; each end of the roll being in the same operation beaded. It is impossible to remove a single coin without breaking the beading, which shows the completeness of, and cleverness represented by, the invention. The roll of coins, after being wrapped, is dropped into a receptacle, labelled with the denomination and amount, and, if desired, the title and address of the gas company or committee, as the case may be—the whole of the operations being performed at the rate of 400 to 500 coins per minute. The complete rolls of money with the neatly beaded ends, look almost exactly like cartridges, and, as already said, are so securely wrapped that it is impossible to extract a single coin without destroying the whole roll.

The machine can be adapted to deal with any coin, either copper, silver, or gold; and it is so accurate that each roll is a guarantee of its face-value; and, like a bank note, requires no counting. The machine is rather larger than a typewriter, and is actuated by a small electric motor of $\frac{1}{16}$-horse power; the cost of current being as low as 2d. or 3d. per day. As the only manual labour required is that necessary to keep the machine fed with coins, a boy or girl can work it. The expense is therefore almost infinitesimal. The machine is not completely wedded to electricity for its motive power; any other convenient power can be used, or, if preferred, treadle machines can be had.

Another very ingenious device that was inspected is an automatic cashier. This machine has a keyboard on the same principle as a typewriter, but each key is marked with amounts starting at 1d., and increasing by penny stages to 19s. 11d., with separate keys for sovereigns, half sovereigns, and half-pennies. The purpose of the machine is principally for wage paying where a large number of hands are employed. Coins of each denomination are placed in a grooved tray in the machine—one groove for each denomination. Then by simply pressing one or more keys separately or simultaneously, the sum required falls through a slot into the hand, bag, or any other receptacle. The mechanism is so constructed that it is impossible to pay either more or less than the amount designated on the key depressed; and if any denomination of coin is exhausted, the "cashier" is locked automatically as long as that particular denomination of coin is included in the sum to be made up, though the machine will deliver any other combination of coins which does not include the type that is exhausted. So long, therefore, as the right keys are depressed, it is impossible to make mistakes. The "cashier" can be re-charged in a few seconds. The utility of the machine to firms paying wages to a large number of hands is obvious, as, by using it, the whole wages can be paid by one operator in far less time than by the ordinary method. There is, in fact, no comparison. The machines are both time-savers.

A GAS AND WATER TIGHT ELECTRIC SWITCH.



ATTEMPTS have been made from time to time to produce an enclosed switch which would be suitable for use in collieries, or in places where there are explosive gases; but up to now these have not been successful. The weak point has usually been that, though the switch could not be put on until the lid was closed, there was no provision for ensuring that it was absolutely shut and was gas-tight. This and some other defects Messrs. Donovan and Co., of Birmingham, claim to have overcome by the simple yet effective means here shown.

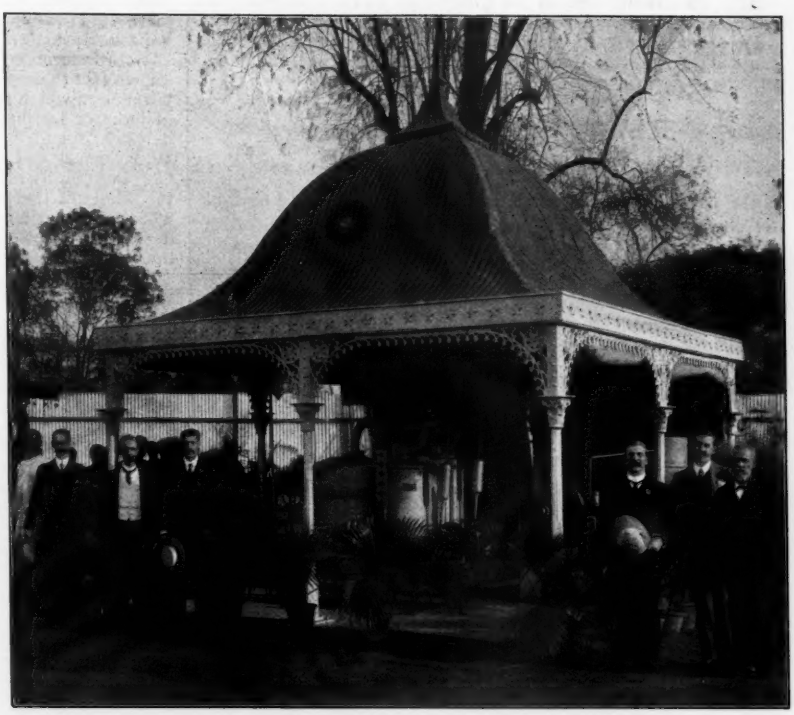
The above is an illustration of one of the firm's patent 200 ampere, 500 volt, 6-inch switches. The lid is fastened down to a rubber gasket by means of the swivel bolt A, which engages the handle until a hole in the projection attached to the lid is opposite the bolt B, and allows the bolt to be thrown out of gear with the handle; thus leaving the switch free to be operated at will. The contacts of the switches are of Messrs. Donovan's registered design, the object of which is to obviate useless and inefficient contact surfaces, &c.; and the joints are arranged for easy connection to cables. The switch shown—numbers of which are, we are informed, in use in collieries and other places where explosive mixtures may be found—is fitted with gas and water tight glands.

The Metropolitan Water Board have increased the salary of the Comptroller (Mr. F. E. Harris) by £250 per annum.

Mr. Lynch White, J.P., of Leigham Lodge, Streatham, the Chairman of the Thames Bank Iron Company, who died a short time since at the age of 86, left £61,521.

MODERN GAS LIGHTING DEMONSTRATION IN CALCUTTA.

We are always glad to learn of gas-lighting successes in distant parts of the globe. The Oriental Gas Company have done magnificent service to Calcutta, with credit to themselves, by keeping absolutely up to date in introducing, through their energetic Engineer and Manager (Mr. J. C. Watson) and his capable staff who heartily second his efforts, the most modern productions of invention for the economical and efficient utilization of gas. It is part of the Company's policy, as it is of all enterprising undertakings, not to let any opportunities slip; and an opportunity of showing to Calcutta the splendour of the latest types of incandescent gas lighting was offered when the organization was mooted of what became to be known as Her Excellency Lady Minto's "Fête in Aid of Indian Hospitals." Mr. Watson was appointed to serve on the Lighting Committee; and his expert knowledge enabled him to render yeoman service in assisting to make the fête brilliantly attractive—his proposals receiving the cordial endorsement of his Chairman (Mr. R. Hesketh Jones) and the Board in London. The fête commenced on Jan. 28, and continued for nine days; shows being held afternoon and evening. The scene of the fête was the Maidan, which is in the central part of Calcutta, and is practically the Hyde Park of the city. It was a great show; and was exceedingly successful. Our last dispatched information says the official report mentions that the amount realized for charities has reached about £23,000,



The Gas Pavilion, and the Men who Did the Work.

One of the Avenues in the Fête Grounds by Gaslight.

which is certainly a very substantial sum considering the small European population of Calcutta.

The Oriental Gas Company's contribution to the fête was one which gave much gratification, and evoked much admiration. The exhibits, gas, labour, and everything attaching to the display were given freely, and without any restraint upon the liberty of Mr. Watson and his staff, who threw themselves into the matter with much enthusiasm both out of loyalty to the Company and from sympathy with the cause of the fête. They had a Gas Pavilion, illuminated one of the main avenues, and lighted the horticultural show and Lady Minto cottage, with the flower show annexe, photographic salon, telescope enclosure, "Shannon river," motor horse switchback, shooting galleries, refreshment rooms, &c., as well as the tea gardens, and the exit road and gateways. We reproduce a photograph of the Gas Pavilion, and of the gas-lighted avenue in the fête grounds—the Gas Pavilion being on the extreme left of the avenue. The latter photograph was taken by gas-light at between seven and eight p.m., in the time intervening between the afternoon and night shows, when the grounds were free from visitors. The Company exhibited lamps from 1000-candle power down to the bijou inverted burner giving 18-candle power per cubic foot of gas consumed—in fact, the opportunity was taken to show all the latest forms of gas lighting by compressed and low-pressure gas. In the photograph of the Gas Pavilion are seen the Keith and Blackman gas-compressor (No. 6 pattern); and the operating gas-engine. The compressor, Mr. Watson reports, worked splendidly. Then in front of the picture are seen six pneumatic lighters, by means of which, with half-a-dozen Welsbach burners at the back of the pavilion, it was demonstrated that, in convenience of lighting and extinguishing, gas (apart from its superior illuminating value for expenditure) can rival the electric light. The pavilion itself was lighted with two 600-candle power Keith lamps; and there were also exhibited (in addition to the range of gas-lamps from 1000-candle power down to the bijou inverted) specimens of mantle fibres, the details of mantle manufacture, and samples of rotary meters—in fact, most things modern in gas utilization that are suitable for use in India were on view. Visitors were all vastly interested; and the Company's attendants were inundated with inquiries.

One other interesting point about the Pavilion photograph. The Company's representatives who took part in the organizing of the gas-lighting part of the display were incorporated in the photograph. Looking from left to right, we have Mr. H. Park (of the meter and incandescent departments), Mr. A. G. Peters and Mr. C. Phillippe (of the main-laying department), then our old friend Mr. J. C. Watson (wearing his General Committee badge), Mr. L. G. Barber (Second Assistant), and Mr. J. Phillippe (outdoor foreman).

The residents of Calcutta visited the fête in large numbers, and so the Gas Company obtained what must be described as a splendid advertisement. The lighting was greatly admired; and the local Press gave it much merited praise. The "Indian Daily News," as one example, remarked: "The lighting of the grounds was superbly done." No pains were spared to earn this verdict. Those who had taken part in making the fête attractive and a success were most warmly thanked by Lady Minto. Her

Excellency was good enough to express to Mr. Watson her thanks for what the Company did for the success of the show, and for the laudable object for which the fête was instituted. Similar acknowledgment of the Company's services was made in the official report. A souvenir which Mr. Watson will always value very highly was also presented to him by Her Excellency. We congratulate the Company and all concerned in this demonstration.

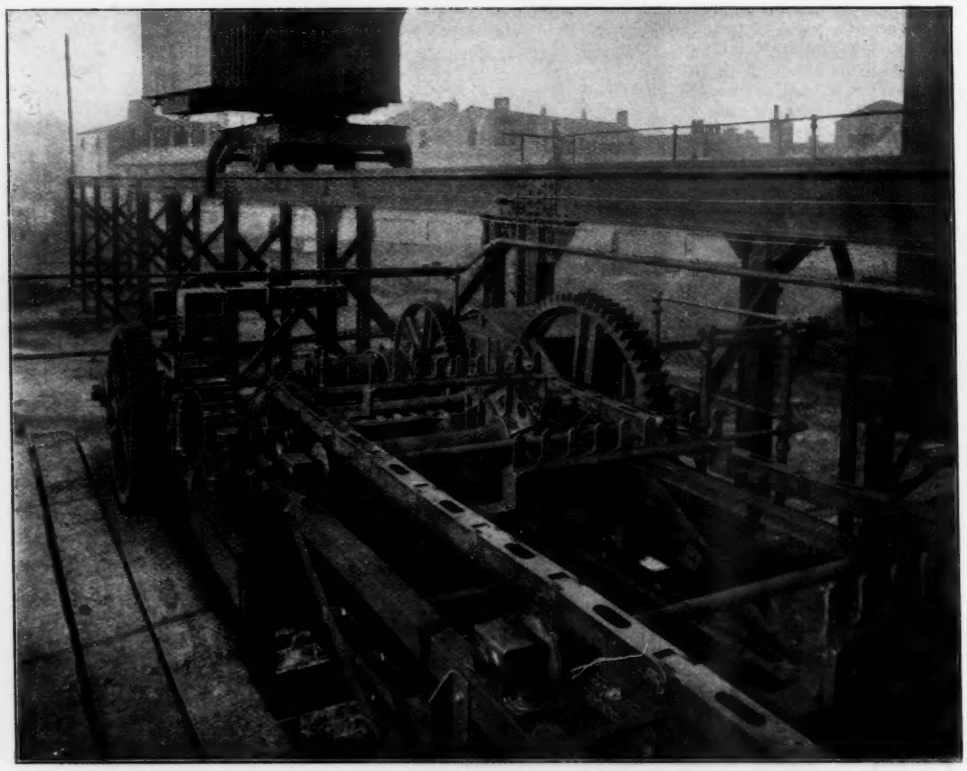
ELEVATORS AND CONVEYORS.

By H. J. Toogood.

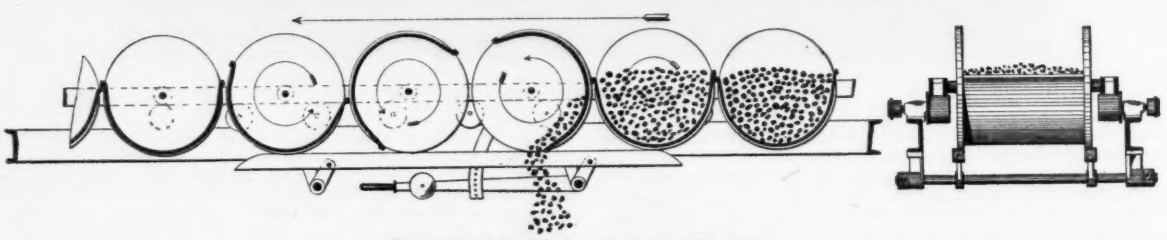
In the paper on the above subject read by Mr. W. B. Leech at the recent meeting of the Eastern District Section of the Scottish Junior Gas Association, the author referred to the disadvantage of hexagonal and polygonal driving-drums as used in connection with conveyors and elevators. He also gave particulars of an improved form of tipping gear for gravity bucket conveyors. Readers of the "Journal" may be interested to learn how these problems are being met by other specialists in the economical mechanical handling of material; and therefore I send a few remarks and two illustrations showing the application of two recent improvements in conveyors, &c.

With reference to the hexagonal driving-drums, it is a well-known fact that when such drums are revolving at a uniform rate, the motion which they impart to the chains partakes of a series of jerks or fluctuations in speed—the amount being, of course, entirely dependent on the number of sides to the polygonal drum. With a hexagonal drum, the fluctuation amounts to 15 per cent. One can readily imagine the excessive strain brought to bear on the whole of the pin-joints of the chains, &c.; and in the case where an electric motor is directly coupled to drive the conveyor, it must of necessity be very severe on the motor, as these pulsations would occur every half-second.

To overcome this, the writer has designed an arrangement of spur-gear drive, whereby power at a constant speed of rotation



Toogood's Patent Compensating Gear for Conveyors and Elevators, as Applied to the Stockport Hot-Coke Conveyors.



Toogood's "Tippit" Gravity-Bucket Conveyor.

(viz., an electric motor) is transmitted through the two eccentric spur-pinions in such a way that the hexagonal drums receive an ever-changing rate of revolution exactly in opposition to their original tendency to fluctuate the speed of the chains. The result of this arrangement is that the conveyor is pulled forward at a continuous and uniform rate; the whole of the gearing, chains, and motor being thus relieved of the shocks already alluded to, with evident advantages.

The patent was fully described and illustrated in the "Journal" for Nov. 1 and Nov. 8, 1904.

It is interesting to note that no special wheels are employed; all wheels being of plain, ordinary, spur-gear—the only departure being that the pinions are keyed eccentric to their respective shafts.

An application of the gear is shown driving a hot-coke conveyor, from which the simplicity of the gear is evident, and also its adaptability to any type of conveyor or elevator.

Having reference to the tipping mechanism for lipped gravity bucket conveyors, the experience of users in the past has been that the oscillation of the buckets causes the lips to collide one with the other, and this has resulted in breakage of the lips. The conveyor that I invented some time ago, and is here described, is a radical departure from previous designs of gravity bucket conveyors, inasmuch as nothing is left to chance, as each bucket is inverted—thus with certainty discharging its contents (whether it be coal, coke, lime, or oxide, in any condition, wet or dry), and then quietly and steadily continuing the revolution until the bucket comes to rest without shock or jar. Furthermore, the shape given to the bucket, while obviating the necessity for a pair of cams secured to each bucket, also permits of a greater cubical capacity being contained by each bucket. In fact, there is quite 30 per cent. more capacity than in an ordinary shaped bucket of similar over-all dimensions—thus permitting the same bulk of material to be handled in the same time, with less speed on the conveyor, with consequent reduction in wear and tear. Another feature is that, instead of the chain carrying the rollers, the position is reversed. The rollers carry the chains, with evident benefit, since their dead-weight is not being conveyed continuously.

The sole right of exploiting these improvements is vested in Messrs. Robert Dempster and Sons, Limited, of Elland, Yorks.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

Public Lighting.

A Meeting of the Association was held on Wednesday last, at the Cripplegate Institute, E.C., under the presidency of Mr. W. Upton, who at the commencement of the proceedings announced two attractive fixtures. On Tuesday, the 9th prox., the members have been invited to pay a visit of inspection to the works at Luton of the Davis Gas-Stove Company, and also to the Luton Gas-Works; while arrangements have also been made for a "scientific-social" evening (which promises to be a most successful function) to be held in the large hall at the Cripplegate Institute on Saturday, May 4.

The paper submitted to the members last Wednesday was a lengthy, and highly practical one—on "Public Lighting," by Mr. E. W. Eldred, of the Gaslight and Coke Company. It was divided into two parts—the requirements of public lighting, and the means by which these requirements are carried out. The author pointed out that if a lamp was fixed in a country road, all that was needed was that it should light up the different turnings and obstructions, so that they could be seen from both ways of approach. With what he termed "suburban" roads, however, he laid down the following rule for the distances lamps should be fixed apart. Other than busy main roads: For a 40-feet roadway, lamps to be 30 yards apart; a 30-feet roadway, 35 yards apart; and a roadway under 30 feet, 40 yards apart. Busy main roads: For a 50-feet roadway, lamps to be 20 yards apart; and for a 45-feet roadway, 25 yards apart. The distance between each lamp is, of course, measured along the centre of the road. In all suburban roads, the corner lamps should have twin burners; and all lamps in the busy main roads should be so fitted. The burners need not in any case consume more than 4 cubic feet per hour. The use of double-burner lamps at corners, he pointed out, made it possible to do away with refuge lamps, which were a nuisance, and should be very sparingly employed, especially as motor traffic was so largely on the increase. For the principal town and city roadways, the following rules were laid down for distances apart of lamps, &c.: Side turnings, same distance as for suburban roads, but larger burners. Up to 60 feet roadways, lighted from footway, twin No. 4 burners parallel to roadway, lamps 20 yards apart. From 60 to 80 feet roadways, one line of refuge columns down the centre 30 yards apart; 200 to 300 candle power self-intensified lamps and single burners on the footway in between. From 80 to 90 feet roadways, one line of refuge columns down the centre of the road, 30 yards apart; 400 to 500 candle power self-intensified lamps, and twin burners on the footway. From 90 to 100 feet roadways, a double row of refuge columns placed alternately 30 yards apart; 500-candle power self-intensified lamps, and twin burners on the footway in between. Lamp-columns should never be placed opposite each other. Suitable heights for different columns were: For 200 to 300 candle power lamps, 12 feet; 400 to 500 candle power, 14 feet; 600 to 800 candle power, 16 feet; and 900 to 1000 candle power, 18 feet—the light being about 2 feet higher in each case.

Coming to the second part of his subject, Mr. Eldred said that in the case of country roads a No. 3 size cast burner was the best. The light was sufficient, and the burner would not require much attention. For suburban roads where there was a certain amount of reflection from the houses, the same burner would do, with twin burners at all corners and open spaces; but in main-road busy thoroughfares No. 3 twin burners should be used throughout. For all central lighting, such as squares, self-intensified lamps should be employed. The lanterns should be of part copper and part tin. There was no advantage gained by expending a lot of money on all-copper lanterns; and should improvements come along, there would be less to scrap in the first case than in the second. They should be so constructed that the cold incoming air went down on the inside of the glass, and did not come in contact with the hot air rising from the burner; and they should be wind and rain proof. The reflector should be of the very best porcelain; enamelled iron being tabooed as the worst enemy of street lighting. In town and city roads, the side turnings should have No. 4 single burners, with twin burners at the corners; the main roads, twin No. 4 burners; and at special spots self-intensified lamps. For thoroughfares that needed special treatment, and it was a question of high-pressure or self-intensified lighting, he preferred the latter (except where there was a high-pressure main), for the following reasons: Economy in capital outlay; economy in maintenance; each self-intensified lamp was an independent unit, and if one failed the danger to traffic was but slight, whereas with high pressure when used with an apparatus the danger of failure was ever present. Then, again, the efficiency in candle power per cubic foot was in favour of the self-intensified lamp; and he thought that it had more chance of being adopted, as the borough authorities were becoming more alive to the fact that the only way to secure uniform lighting of the streets was by small units at close quarters. There was also, of course, the consideration of cost. There was a self-intensified lamp coming along that would be guaranteed as to its durability and reliability, and that would give an efficiency of from 35 to 40 candle power per cubic foot. It could be fitted to existing electric light columns or to ordinary lanterns. As to the best system of high-pressure lighting, he had yet to be convinced that it was necessary to work at a higher pressure than 20 inches. In his opinion, from 8 to 20 inches was ample, and was the most economical pressure. If there was a high-pressure main running through a thoroughfare, it should be made use of, for it would then naturally be the cheapest and best method of lighting. But all high-pressure systems, when worked by apparatus, should be able to go on to low pressure and give a fair light in case of any breakdown.

Mr. Eldred next referred to the tables of comparison as to the candle power and cost of electric light, high-power lights with auxiliary pressure apparatus, and self-intensifying gas-lamps, prepared by Mr. James Foreman, in connection with a paper read by him before the North of England Gas Managers' Association last April [see "JOURNAL," Vol. XCIV., p. 310]. He remarked that gas was easily first, and that the Scott-Snell system obtained the best result, both as to efficiency and economy. Following this, the subject of burners was touched upon. All burners, said the author, should be of heavy make; and he preferred a cast No. 3 to a "C." When, however, the latter was used, an 8-inch chimney should be fitted. An 8 in. by 2½ in. chimney to fit a "C" burner was an exceedingly useful type, and was more economical than the ordinary straight-up-from-the-gallery type; the breakages were considerably less. The glass should be just within the hole of the reflector, which would enable the light to be higher in the lantern. To his mind, the best results from the light were obtained when it was not less than two-thirds up in the lantern—in other words, the nearer the reflector the better the distribution of light. The glass having been so fitted that it was just within the hole of the reflector, an intensifying action would be set up in a minor degree, which would have an excellent effect upon the light—not only increasing its efficiency, but producing a steadiness that was frequently missing in a "C" burner. This arrangement necessitated a bye-pass, which he regarded as quite an advantage. Cast burners should have at least a 6-inch chimney, and be placed high in the lantern, with a bye-pass. The Kern burner, he roughly estimated, cost twice as much for maintenance as a cast burner; and a "C" burner slightly less than a Kern. The Kern undoubtedly gave a higher efficiency at the start; but the decrease was considerable after a little while, whereas a cast burner as a rule would maintain a general efficiency—which after all was far better for public lighting.

The author said he did not advocate anti-vibrators in any other than exceptional circumstances; but whatever pattern was used, it was no good if it allowed the burner-head and the mantle to vibrate from side to side. The lateral vibrations it was that so quickly destroyed mantles; and the point was to transform them into vertical ones, where they would do least harm, and were best taken up. Governors should be changed not less than twice a year. Frequently burners were condemned for firing-back, when the seat of the trouble was that the governor was sticky, and worked stiffly. Under the present conditions of the manufacture of gas, he considered the diaphragm governor the best to use. As to the question of open frogs or cast bases, he preferred the open frog and glass bottom lantern. It was cheap, and threw but a small shadow, which was split up; while the cast base was very costly, and threw a dense shadow all round the base of the column. The point brought forward by the supporters of the cast base, was that it maintained everything perfectly rigid; but if the frog and standpipe were properly wedged, and there was a slight play between the spindle of the cock and the hole in the base of the lantern, the efficiency of the whole was as great as that of a cast base, without all its attendant expense and intricacies. It was difficult as yet to criticize inverted lamps, as they were only in the experimental stage. The instance so freely quoted—of an installation in a country place, where flat-flame burners were taken out and inverted burners put in the ordinary lamps—would, of course, show good results; but what they had to do was to improve upon the existing installations of incandescent lighting, and this was still in the experimental stage. He was, however, firmly convinced that it would be an improvement which would show a higher efficiency at less cost.

Maintenance was the next matter dealt with; and with regard to this, Mr. Eldred said there were three points to be borne in mind—efficiency, speed, and economy. Efficiency meant that the men attending to the lamps must know what to do and how to do it; and therefore the men must be well instructed. By speed, he did not refer to the rapidity with which a man could rectify a defective light or burner, but rather how long after lighting up it was before every lamp was in good order. Economy covered the materials used in renewals of all kinds to burners, mantles, &c., and also special maintenance wages. His idea of the best way to maintain lamps was, first and foremost, to make all men responsible for their own particular lamps in every way; individual responsibility was the key-note of his ideal system. He would have one man to an average of eighty lamps for maintenance; and as he would be responsible for his own work, he would see that it was all right before he started lighting, so that when he had finished lighting he ought very seldom to have to go back on to his work again. He would arrange for the men to come back over some of their own ground again, and all to look out for anything amiss; and in the manner he had sketched, the maintenance would be completed on an average about 15 minutes after lighting up every night. To his mind, all the lamps should be maintained at the highest point of efficiency whatever the cost; but at the same time the cost must be kept down as low as possible. To do this, one must know the number of lamps and burners and the quantity

of mantles used by each man, and so keep a check upon him. Under the system outlined, there would not be any special maintenance men, and therefore no extra wages, as each man would have to do his own maintenance. When they found a mantle that was strong and gave a good average light, they should stick to it, but frequently test it on the photometer, and if it showed any falling off either change it or get it improved. Shocking machines he did not consider much use; the mantle average was a far better test, and more satisfactory to all concerned. Comparisons had been made of the cost of maintenance on the Continent and here; and he had come to the conclusion that in London at all events the same good results could not be secured owing to the excessive moisture and condensation, that helped so much to shorten the life of mantles and to corrode burners of the Kern and "C" type, necessitating far more frequent attention than would be necessary in a drier atmosphere.

In conclusion, the author gave a description and a practical demonstration of the Rostin and the Alder and Mackay automatic lighting and extinguishing systems, which were referred to and illustrated in Mr. S. O. Stephenson's paper read recently before the Midland Association [see *ante*, pp. 604-609]. He pointed out that the requirements of London and the methods of distribution by which it was served, were unique; so that the question of automatic lighting by pressure needed very careful thinking about. Taking everything into consideration, he thought that an apparatus that worked with an extra pressure of 1-10th or 2-10ths was required for London, though where the conditions suited the Alder and Mackay apparatus (which could only be worked at a minimum extra pressure of 5-10ths, while the makers preferred more) he imagined it would prove satisfactory as well as a good deal cheaper. The convenience of an automatic arrangement was great, and maintenance with one in use was more economical; so that he believed the plan would become pretty general as time brought experience and improvements.

After the author had sat down, some comments were made, and questions asked, by the members. The President remarked that he noticed Mr. Eldred said the use of double-burner lamps at corners made it possible to do away with refuge lamps, which were a nuisance; and then later on he suggested for 60 to 80 feet roadways, and wider, a line of refuge lamps down the centre of the roads. This seemed a contradiction. As to the advocacy of part copper and part tin lanterns, it should be remembered that after lamps had been up for some time tin-work was no good for scrapping, whereas copper was always worth its weight as a metal. Mr. Tooth referred to the author's statement that, while the Kern burner undoubtedly gave a higher efficiency at the start, the decrease was considerable after a time, whereas a cast burner as a rule would maintain a general efficiency; and he said he would be glad to know why the efficiency of the Kern dropped. To his mind, the Kern was the most perfect low-pressure burner of the present day, though as regarded maintenance no doubt it was a mantle waster. Mr. Winslow inquired what self-intensified lamps the author had had experience of. He said that most unfortunately at Walthamstow the Council had their own electric light installation, and so what few gas-lamps there were had to look after themselves. On these few gas-lamps the Council had "C" burners; and they had tried to cut down the light to more or less equal that of the electric lamps. They put 3 feet governors on the burners, which, of course, required 4 feet, and so reduced the candle power by something like 50 per cent. They next fitted specially short mantles, to suit the flame given by this 3 feet. People who did not know that the Council maintained the gas-lamps put the result down to the Gas Company; and so it was not a very good advertisement. He could not see himself where "the ever-present danger" would come in with high-pressure lighting. Mr. Grimwood remarked that the author seemed to have had good results from the Scott-Snell lamps; and he asked why they were displaced in Whitehall. The President said Mr. Eldred had taken up what he assumed to be a model position, and had stated that the result of the system he advocated would be that "the maintenance would be completed on an average about 15 minutes after lighting up every night." Was this a model case, or was it actual practice? If the latter, he thought it was exceedingly good work. From personal observation, he had noticed that more often than not it was an hour after lighting-up time before maintenance was completed. Did the author know of any place where 15 minutes' allowance, or about that, was a working proposition?

In replying to the discussion, Mr. Eldred pointed out that when first mentioning refuge lamps, he said that the necessity for them would be obviated by having double-burner lamps at corners. In city roads, however, traffic was not allowed at an excessive speed; and the matter was different. In the former case, refuge lamps should be done away with; but in city roads with an immense traffic, it was necessary to have them. They should, however, be so placed that there was room for two lines of traffic in either direction. The time he had mentioned for maintenance—15 minutes—might perhaps appear to be a little far-fetched; but he had had a special average got out for the last four weeks, during which there had been a particularly high wind. This average worked out to 7 minutes—not 15 minutes. The reason for the deterioration of the Kern burner was that the condensation was so great with the air of London that it corroded not only the tooth-wheel, but the inner cone as well. He had had to keep a pair of fitters continually on the move throughout his district filling in their time attending to maintenance of the Kern burners. When referring to No. 3 burners, he did not mean the No. 3 Kern, but a cast burner—that was, a Sugg, a Bray, or an Edgar. He did not know why the Scott-Snell lamps were displaced in Whitehall; but he put it down to the fact that the Sugg system was there and partly in operation before, and so it was merely an extension. This, however, was purely supposition on his part.

On the proposition of the President, a very hearty vote of thanks was accorded to Mr. Eldred for his paper.

YORKSHIRE JUNIOR GAS ASSOCIATION.

Under the chairmanship of the PRESIDENT (Mr. G. W. Fligg), the members of the Association gathered at the Municipal Technical College, Bradford, on Saturday, to hear the two papers read which are given below.

Mr. E. J. SUTCLIFFE read the following paper entitled—

HYGIENICS OF THE GAS-STOVE.

"It is admitted that perfect combustion is possible with a properly regulated flat-flame burner. Are not the products of combustion from a properly made blue flame identical, and therefore is not the general impression that a blue-flame stove should have a flue connection, and that such a connection is unnecessary for a luminous flame stove, erroneous?" This was one of the questions sent out to the members last year; but, though two afternoons were devoted to the list, it was not reached. The discussion of this particular point appeared, from conversation I had with a few members, to be anticipated with some interest; and I therefore promised to give a paper on the subject, but somewhat regretted having done so, when almost the first article upon the question as to which was the best flame for heating purposes that I read in the "JOURNAL OF GAS LIGHTING" stated: "Whoever attempts to write critically upon gas-stoves without knowing all that has been written and done for the elucidation of this point by truly scientific workers, is to this extent unfitted to his task." [Vol. 62, p. 1032.] This remark set me to work hunting up every available article which bore any reference to the subject; and it is almost unnecessary for me to state that the value of the experiments by experts which are quoted is far greater than would have been that of any which I might have made in support of my contentions.

There are three different ways in which gas may be burnt: (1) For light, in which the gas is not supplied with any air before it reaches the point of ignition, but on reaching this point is furnished with sufficient for its complete combustion. Here there is a luminous flame. (2) For heat, when the gas receives, and is mixed with, a partial supply of air previous to ignition; the remainder necessary for complete combustion being supplied at the point of ignition. Here the flame is blue or greenish blue and non-luminous. The great heat of this flame is now utilized by means of the Welsbach mantle to afford light also. (3) For power, in which the gas is, before ignition, mixed with sufficient air for its complete combustion; and there the combustion is so rapid as to make an explosion. This method, however, does not enter into our deliberations to-day.

When coal gas is burned completely, the products of combustion consist of carbonic acid, water vapour, nitrogen, and (if any sulphur be present in the gas) sulphurous acid. If even ordinary ventilation is provided, no ill-effects would result from the liberation of these products in a room; but if from any cause combustion is rendered imperfect, carbon monoxide, acetylene, marsh gas, carbon, and hydrogen may be found to be given off in considerable quantity.

In the question, it is admitted that perfect combustion is possible in a luminous flame; and such an admission was borne out by the Commission appointed by the "Lancet" in 1894 to report upon the hygienic value of gas for cooking and heating purposes. This Commission reported, among other things, that with a Bray's batswing burner, burning 6 cubic feet per hour, no distinct evidence of undesirable products in the burnt gas was found, though there were slight indications of carbon monoxide; while the presence of even a trace of acetylene was "doubtful." [J.G.L., Vol. 65, p. 123.] Lewis T. Wright has put on record the fact that,

> On two different occasions, he has sought for and endeavoured to find, traces of unconsumed gas escaping from the normal flames of ordinary gas-burners, both lighting and non-luminous. . . . The results were in every case negative; and not the slightest trace of carbon dioxide formed by the oxidation of carbon monoxide or of other products of unconsumed coal gas could be detected.

His method of testing was as follows:—

> The burners were placed in a small room, the air of which was tested in order to ascertain that there were not present any carbon compounds (escaping coal gas) that would give the reaction sought for. A tube was placed over the flames, but not so as to touch them; and the products of combustion, mixed probably with some air, were drawn through vessels containing cotton-wool to remove dust, organic matter, &c., and then through a column of soda-lime to remove the carbon dioxide. The gases so purified were afterwards passed over copper oxide that had been prepared *in situ* by the oxidation of fine copper wire, and then through bulbs containing lime water. [J.G.L., Vol. 66, p. 1024.]

From tests made on batswing and argand burners under the direction of Dr. Bunte, that eminent chemist is satisfied that

The ordinary gas-flame under normal conditions yields no quantitatively determinable amounts of products of incomplete combustion. [J.G.L., Vol. 66, p. 179.]

In 1895, Professor Gellmuyden, of Christiania, published the results of some experiments he had conducted; and from these, he concluded that,

With a slit burner or an argand burner, there are no hydrocarbons or carbon monoxide liberated on combustion. [G.W., Vol. 23, p. 12.]

In last year's "Question-Box" of the Ohio Gaslight Association, the following question was asked: "Is perfect combustion possible with a perfectly regulated illuminating or flat-flame burner?" Out of nine answers, seven were affirmative.

Against all this evidence, Professor Lewes has stated that

The gases leaving the luminous flame show that the diluting action of the nitrogen is so great that considerable quantities even of the highly inflammable and rapidly burning hydrogen escape combustion; while the products of incomplete combustion are present in sufficient quantity to perfectly account for the deleterious effects of gas-burners in ill-ventilated rooms.

He arrived at this conclusion after

Taking a small platinum pipe with a circular loop at the end, the interior of the loop being pierced with minute holes; and by making a circular flame burn within the loop so that the non-luminous zone of the flame just touched the inside of the loop, and then by gentle aspiration withdrawing the gases escaping from the outer zone and analyzing them.

The following were the figures he obtained with a luminous flame: Nitrogen, 76·612; water vapour, 14·702; carbon dioxide, 2·201; carbon monoxide, 1·189; oxygen, 2·300; marsh gas, 0·072; hydrogen, 2·388; acetylene, 0·036. [J.G.L., Vol. 56, p. 1335.]

On another occasion he stated that a luminous flame consists of three parts—the inner zone, the luminous zone, and the

Extreme outer zone, in which the cooling influence of the entering air renders a thin layer non-luminous, and finally extinguishes it. With an ordinary coal-gas flame, this results in the escape of traces of hydrogen, methane, acetylene, and carbon monoxide; while with a very rich gas, unconsumed carbon also escapes. [J.G.L., Vol. 59, p. 797.]

Though it may be presumption for me to criticize Professor Lewes's conclusions or his methods, it appears to me that the Professor would have been justified in drawing the conclusion he did if in his experiments he had collected the gases from just outside the outer zone of the flame, instead of having his flame "just touched" by the inside of the loop of the pipe through which the gases were aspirated; for there would be great danger of the gases being withdrawn from a part of the flame where combustion was not complete. And, again, the fact that the tube touched the flame is, to my mind, sufficient to vitiate the conclusions at which he arrived; for, in his own words,

It is the contact of the body to be heated with the flame before combustion is complete, that gives rise to the mischief. Any cooling of the flame extinguishes a portion of it; and the gases present in it at the moment of extinction creep along the cooled surface, and escape combustion. . . . It is impossible to check the flame anywhere short of the extreme tip without liberating deleterious products. . . . Even in the extreme tip of a luminous flame, it is impossible to heat a cold body without giving rise to carbon monoxide. [J.G.L., Vol. 56, p. 1336.]

Many years ago, experiments were conducted by Landolt in Bunsen's laboratory, under the direction of that great chemist himself, upon the gases in the various parts of a rat-tail flame. In order to collect the gases at the different parts of the flame, a very fine suction tube was placed vertically in the axis of the flame, which was 100 mm. high; and it was found that the small amount of suction necessary to draw the gases through the apparatus reduced the height of the flame 10 mm.; that it was impossible to continue the investigation on the composition of the flame gases beyond a height of 55 mm. above the burner-head, because of the deposit of free carbon; and that the fine wire passed through the suction-tube to clear it of the carbon caused inconvenient deformation of flame. [J.G.L., Vol. 66, p. 1023.]

This is further evidence in support of my contention that in Professor Lewes's experiments the gases he withdrew were not only withdrawn before combustion was completed, but also that his method of taking off the gases interfered with perfect combustion, and completely vitiate the conclusions he drew from his experiments. The bulk of available evidence therefore appears to me to be in favour of the possibility and probability of perfect combustion taking place in coal-gas luminous flames. When coal gas is burnt completely with a blue or atmospheric flame, the products of combustion are identical with those of the same gas when burnt completely with a luminous flame. The point as to whether perfect combustion is attained in atmospheric burners in ordinary practice will now be considered.

Mr. Lewis T. Wright has already been referred to when I gave the negative results of his experiments made in order to discover products of incomplete combustion from both luminous and blue flames. He repeated his experiment with large bunsen flames, in which the proportion of air primarily admitted was so large as to approach the point at which the flame would light-back; but again he got negative results. [J.G.L., Vol. 66, p. 1024.] The "Lancet" Commission, also alluded to previously, applied some very stringent tests in order to ascertain the presence or absence of carbon monoxide or acetylene in the products of combustion from a number of Welsbach burners. Their findings are summed up in the following sentence:—

Even when the gases were aspirated for hours straight from the chimney of the Welsbach burners, neither of the gases carbon monoxide or acetylene could be detected. [J.G.L., Vol. 65, p. 123.]

Dr. Bunte had made, under his direction, tests of the combustion products from ten incandescent burners, an argand burner, and a hollow-top batswing burner (the experiments being conducted in a manner somewhat similar to those of Mr. Wright already described); and he found that,

Calculating into percentages of carbon monoxide in the undiluted exit gases, in most cases the amount was expressed in thousands of a volume per cent. only; and consequently it was within the limit of experimental error. Therefore the combustion must be regarded as perfect with these burners. . . . "The incandescent burner, under normal conditions, yields no quantitatively determinable amounts of products of incomplete combustion." [J.G.L., Vol. 66, p. 179.]

In his lecture upon the bunsen flame, given at our inaugural meeting in 1903, Professor Smithells said:

Neither the bunsen flame burning freely in the air, nor a flame of a properly-constructed burner giving a luminous flame, yields products of imperfect combustion to any appreciable degree. [Yorkshire Junior Gas Association Report, p. 9.]

Here, again, Professor Lewes has pronounced against the possibility of complete combustion; for he gives the following as the composition of gases taken from a bunsen flame by the same method as that described in his analysis of gases from a luminous flame: Nitrogen, 80·242; water vapour, 13·345; carbon dioxide, 4·966; carbon monoxide, 0·006; oxygen, 1·430; marsh gas, 0·003; hydrogen, 0·008. He says:

The air penetrating the flame so dilutes and cools down the outer layer of incandescent gas that it is rendered non-luminous; while some of the gas sinks below the point at which it is capable of burning, with the result that considerable quantities of the products of incomplete combustion (carbon monoxide and acetylene) escape into the air and render it actively injurious. Though the dilution of coal gas by air in atmospheric burners is sufficient to prevent the decomposition of the heavy hydrocarbons with the liberation of carbon, and so destroy luminosity, yet the presence of an extra supply of oxygen does make the combustion far more perfect, so that the products of incomplete combustion are hardly to be found in the escaping gases. [J.G.L., Vol. 56, p. 1335.]

My objection to this is the same as that previously levelled against the Professor's tests on luminous flame products; for he himself has said:

With all stoves in which solid bodies like asbestos are heated by atmospheric burners, a trace of carbon monoxide is produced. [J.G.L., Vol. 80, p. 1621.]

But in this case, the carbon monoxide, marsh gas, and hydrogen are present in such small quantities as to be almost within the limits of experimental error. In subsequent papers and lectures by Professor Lewes, I cannot discover any further reference to these experiments. Yet five years later than the date at which he published these results, I find him saying, in speaking of the two distinct flames of a bunsen burner:

The outer flame is produced by the combustion of the hydrogen and carbon monoxide escaping from the inner zone into the completed products of combustion—carbon dioxide and water vapour. [J.G.L., Vol. 68, p. 1125.]

No mention is made of combustion in the outer zone being incomplete. In his paper to the Gas Institute in 1895, he said:

The only way to get complete combustion is to allow the (atmospheric) flame to burn itself out without contact with any other body. [J.G.L., Vol. 66, p. 21.]

I therefore gather from these later statements that Professor Lewes has changed his mind somewhat since 1890, when he published his figures as to incomplete combustion taking place in blue flames; and I think it must be conceded that the weight of evidence is against the idea that gas burnt freely in air by either good luminous or blue flames gives off products of incomplete combustion. Where these products have been found, the experiment itself should be above criticism; and blank experiments ought first to have been made, in order to prove that the minute quantities found were not present in the air of the room. In my opinion, therefore, the first half of the question must be answered in the affirmative.

The second half brings into play another set of circumstances which has not been considered hitherto; and all these must be taken into account before the question can be answered satisfactorily. The luminous flame which we have previously discussed is one in which the burner, the gas, and the air supply are under direct supervision, and are just what are necessary to each other in order that combustion may be perfect; but when the same burner and gas are used for heating purposes, new conditions, which alter the circumstances altogether, often prevail.

Chief among the disturbing influences may be mentioned: (1) Too great a pressure of gas. Here, the gas rushes out into the air at such a rate as to produce a partial vacuum near the burner orifices, and the air is drawn in and mixes with the gas, cooling and diluting it so much that it burns with a bluish flame, giving little light. Perfect combustion under such conditions is impossible. In argand burners, the flame gives off free carbon. (2) When the gas is turned too low, the flame frequently gives off free carbon. (3) Draughts from open doors are often the cause of imperfect combustion. Excessive draughts or back-draughts

from the flues of stoves have a similar effect. (4) In stoves in which the luminous flame is used, the burners are often fixed in a position out of the vertical. This will cause air-currents to play unevenly on the surface of the flames, with separation of free carbon, &c. One at least of these disturbing influences generally comes into play in luminous-flame heating-stoves in which the heat available is reflected or radiant; and as the burners are often, if not generally, placed out of sight, it passes unnoticed. Though I hold the opinion that in the majority of rooms the ventilation, either provided or accidental, is sufficient to remove the small quantity of injurious products given off without ill-effects on the occupants, it would remove all possible cause for complaint if a flue were provided.

When we come to look at the use of atmospheric burners for heating-stoves, still other conditions come into force. When applied to heating-stoves, the blue flame is generally used to heat asbestos balls, iron fretwork, or some similar material, in order to radiate heat, and also to imitate the glow of a coal-fire. As has been previously pointed out in speaking of Professor Lewes's tests on the combustion products from bunsen burners, when cold substances such as those named are introduced into the blue flame, they interfere with combustion, and the carbon dioxide and water vapour given off are mixed with products of imperfect combustion, and therefore need conducting to a flue. Professor Lewes has said:

Wherever you have an atmospheric gas-flame employed to heat substances like asbestos in a gas-stove, a considerable percentage of inflammable products of incomplete combustion escape unburnt. . . . It is, I think, now thoroughly recognized that it is impossible to do away with products of incomplete combustion as long as the heating flame is brought into contact with any surface cooler than itself. . . . The only way to get complete combustion is to allow the [atmospheric] flame to burn itself out without contact with any other body. [J.G.L., Vol. 66, p. 21.]

In experiments made in 1890 [J.G.L., Vol. 56, p. 1336], the same authority

Determined the composition of the products of combustion and unburnt gases escaping when a vessel containing water at ordinary temperatures is heated up to boiling-point by a gas-flame; the vessel being placed in the first case half-an-inch above the inner cone of the flame, and in the second case at the extreme outer tip of the flame.

	Inner.		Outer.
Nitrogen	75·75	..	79·17
Water vapour	13·47	..	14·29
Carbon dioxide	2·99	..	5·13
Carbon monoxide	3·69	..	—
Marsh gas	0 51	..	0·31
Acetylene	0·04	..	—
Hydrogen	3·55	..	0·47

These figures show most conclusively the evil effects upon combustion of placing comparatively cold substances in the bunsen flame; and I think it must be allowed that, where it is possible for over 3½ per cent. of carbon monoxide to escape with the products of combustion, a flue connection with a reliable draught is an absolute necessity.

In a report upon the "Combustion Products of Gas-Stoves," Dr. T. E. Thorpe found, in his tests of three stoves, that carbon monoxide was present in the products of combustion from each stove, but in such small quantities that the Chief Inspector of Factories (to whom the report was addressed) remarks that the figures show that

While all flueless stoves give off impurities, the most dangerous product—carbon monoxide—is usually present in such small proportion that, with proper ventilation, it could not reach the percentage which has been found to cause mischief. [J.G.L., Vol. 84, p. 476.]

No acetylene was found in the products from any of the stoves. In the report by the Coal Smoke Abatement Society, upon the Thermal Efficiency and Hygienic Considerations of Gas-Stoves, published in the "Lancet" last November [J. G. L., Vol. 96, p. 539], the following conclusions are drawn:—

No carbon monoxide was detected in the hot air and gases coming from these stoves, except in one case; and in this case the makers said that the stove was faulty, and had been sent to the tests by mistake, instead of to their own testing-room. . . . The most likely gas of a poisonous nature which may be present is carbon monoxide; and this is not found under normal conditions in the products of combustion of coal gas. But it may be an intermediate product, as was shown by the "Lancet" Special Sanitary Analytical Commission on Smoke Prevention and Perfect Combustion of 1893. The flue gases were analyzed in several cases during the present tests; but in no instance was carbon monoxide detected in the flue.

Respecting the tests for impurities other than carbon monoxide and carbon dioxide—such as sulphur, unburnt hydrocarbons, acetylene, &c.—they said that they found that the results obtained were so small in all cases as to make the test somewhat unsatisfactory. They tried the same test upon the air in the corridor of the building, and on some scaffolding in the open air, and found that in both cases the amount of these impurities was greatly in excess of that in any of the rooms.

Before concluding, I wish to add a word regarding the gas-cooker. I was without a cooker for some time, because my kitchen was of such a shape that no convenient position could be found for one contiguous to the fireplace or chimney, or even to an outside wall. On reflecting upon the situation, it struck me as being very strange that the makers of cookers considered it necessary to have, and provided for, a flue connection from the oven (where the gas is burnt freely with a plentiful supply of air, and the flames do not impinge upon any cold substance, and are therefore under conditions in which we may conclude that combustion is perfect), while the products of combustion from the boiling and grilling burners on the hotplate (where the bunsen flames are used to play upon iron fretwork and cold cooking utensils, under which conditions Professor Lewes has proved that perfect combustion is impossible) are allowed to escape into the kitchen direct; for it is only in very exceptional cases that a hood is used to remove them. I concluded that if a flue were not necessary for the boiling-burners, the oven itself need not have a flue connection; and I therefore had a cooker fixed without any connection with the chimney. The result has been that my theory proved to be correct; for it is almost impossible for anyone entering the kitchen at any time to know by the smell whether the oven is in use. But the smell from the top boiling-burners is very bad when the ventilation of the kitchen is stopped. I consider it to be far more essential to remove from the kitchen the products of combustion from a flame used on a hotplate to heat (say) water in a saucepan, than it is to use a flue to the oven itself, where the only vapours to be removed are the products of the practically complete combustion of the gas and the vapours evolved from the food which is being cooked. If the kitchen chimney has a good draught, a flap ventilator fixed in it will be quite sufficient to remove all obnoxious fumes, or, failing this means, a window open at the top will probably effect the same purpose. I do not wish it to be understood that I recommend the fixing of cookers without flue-connections; for if it be at all possible such a connection ought to be made. But in cases similar to the one I have just quoted, it is possible, when the ventilation of the kitchen is perfect, to use a cooker without any ill-effects being felt or even noticed.

Discussion.

Mr. M'Nab, in advocating a general adoption of flues, remarked on the greater tendency of the burners of an oven to get out of order than those of the rings—partly because of the difficulty and inconvenience of getting at them for cleaning purposes, and partly because of their liability to get first stuffed up and then rusted up, after washing the inside of the oven. This might easily result in imperfect combustion, and in some burners failing to light, and so allowing small quantities of unburned gas to escape.

Mr. Booth, following on the same side, referred to the ease with which lights might be blown out or might "shoot back," on violently shutting the oven door, when the jets were turned low.

Mr. Walmsley dwelt upon the blocking up of the gas-nozzle, especially as the indrawn air came along the floor, and was likely to be charged with dust; and he condemned the placing of the air-inlet inside the oven.

Mr. Fligg described some modern improvements that facilitated the removal of parts for cleaning, and so lessened the chances of imperfect combustion.

Mr. Cranfield, who proclaimed himself an uncompromising advocate of flue-connections for gas-stoves, emphasized the inadequacy of relying on people's sense of smell telling them when an atmospheric burner had "shot-back." Combustion under these circumstances was imperfect; and among other gases, highly poisonous members of the acetylene series were produced. The escape of small quantities of these gases rapidly produced headache, &c.; and though they had a penetrating and strongly disagreeable smell, he had been greatly struck with the widespread inability or imperfect ability to detect the smell. While many persons could almost immediately detect it, even from distant parts of a house, some failed to notice it when coming direct from the fresh open air, and very many others who would recognize it in this last instance were insensible to it when they had been present from the outset—especially if the gradually intensifying smell was accompanied by the usual odours of roasting. He thought Mr. Sutcliffe was dreaming of an unreached ideal, rather than dealing with existing conditions, when he said that "in the majority of cases the ventilation, either provided or accidental, was sufficient to remove the small quantity of injurious products given off." He regarded the habitual inadequacy of ventilation as one of the banes of life; and cases he had had to investigate professionally had convinced him of the seriousness of the evil, which was manifestly widespread. Perhaps flueless stoves and ovens might indirectly do good by so intensifying the evil as to force attention to it. Carbonic acid was present in the open air to the extent of 0·033 per cent. When, as the result of respiration, this had been increased to 0·06 per cent., there was reached what should be its limit in well-ventilated rooms; while with 0·08 per cent., there was the unpleasant smell familiar on entering crowded buildings. He admitted that here the chief unpleasantness and danger was due to the deadly organic exhalations from the lungs. The amount of these was difficult accurately to estimate; but as it increased proportionately with the carbonic acid of respiration, the amount of the latter was commonly accepted as a criterion of the contamination of the air. He had measured up his own dining-room, and found that to maintain a due purity in it the entire air needed renewing twice each hour for each person in it—no gas being lit. When gas was burnt, the problem of ventilation was much accentuated in difficulty, as each cubic foot of gas took up the oxygen of 8 cubic feet of air; and a burner consuming 5 feet per hour produced as much carbonic acid as five men. As illustrating these points, he ventured to quote from some results he had obtained in investigating the ventilation and lighting of a finely built modern church, which, being very lofty

and roomy, and having but a small congregation, would seem at first sight to be under very favourable conditions. While surreptitious draughts had been carefully prevented, ventilation was almost non-existent except through opened clerestory windows; while the lighting was by flat-flame burners on standards reaching about 2 feet above the level of one's head. During the morning service, the percentage of carbonic acid got up to 0·15; and at night, in spite of some open windows above, it reached 0·35 to 0·39, though during the sermon all lights were turned low. These figures might convey little to anyone unacquainted with the subject; but they were absolutely horrifying to those who realized their meaning. If such results were reached in 1½ hours in a very roomy church, they could imagine what might happen in small sculleries with a flueless stove used for several hours in doing a large baking of bread. He had carefully measured up the scullery in which his own cooker stood, making a deduction for all room occupied by closed cupboards, &c., and he had ascertained the gas consumption. The room was 10 feet high, and not specially small for a scullery; and yet, if the oven flue were removed, the oven jets and top rings all lit, and the windows closed, one-tenth of a minute was sufficient to bring the percentage of carbonic acid up to 0·1 per cent. (which he regarded as the maximum desirable). That was, the entire air would need changing 600 times in an hour. This might not be difficult in such a case as he had recently met with in a friend's house. A flueless oven stood exactly in the middle of the floor of a large kitchen, 8 ft. 6 in. in height; and the mistress of the house explained that they were perfectly satisfied with the arrangement, because in baking she invariably had both the door leading into the garden and the one into the house wide open, and a window also fully opened directly opposite the garden door. Less drastic methods had to suffice in most houses. Important as was the question of the amount of carbonic acid, he was, however, compelled to lay still greater stress on another point, which had not been referred to in the paper—viz., the sulphur dioxide produced by the combustion of the sulphur compounds in the gas. It might, perhaps, seem ungracious and inopportune to refer to this matter just now, when Parliament was so properly relieving gas undertakings from unnecessary and irksome restrictions; but he alluded to it simply as indicating the direction in which the gas industry might avoid a prejudice arising against certain uses of gas, and might guide architects so that in new and large houses gas appliances might not have to be introduced as an afterthought, but be deliberately planned for. Dangerous as carbonic oxide (carbon monoxide) was, 0·05 per cent. in the air was innocuous—at least, for some time—yet 0·001 per cent. of sulphur dioxide was noticeable, and 0·003 per cent. was decidedly and painfully so. Persons differed widely in their susceptibility to its influence; but those with any tendency to asthma and other throat troubles—particularly nervous affections of the throat—were very quickly and powerfully influenced by it. In many cases a few minutes by some gas ovens and rings meant no inconsiderable period of subsequent discomfort. The Gas Referees' allowable maximum of sulphur was 17 grains per 100 cubic feet in summer, and 22 grains in winter. It would be quite safe to assume that this would be exceeded in all cases where no special removal of the sulphur compounds other than sulphuretted hydrogen was carried out, and more especially in those instances where no lime at all was used in purification. He thought he might assume an average of from 30 to 60 grains up and down the country. He had then calculated that his own cooker, with the flue removed and with the windows shut, would, with the oven jets and top rings all burning, reach the perceptible 0·001 per cent. of sulphur dioxide in 2½ minutes if the gas contained 60 grains, and in 5 minutes with 30 grains; while the top rings alone would achieve the same result in 3¾ and 7½ minutes with 60 and 30 grains respectively. These times closely approximated with his own personal experiences. He fully agreed with Mr. Sutcliffe that the top rings of a cooker were often responsible for more mischief and discomfort than the jets of the oven, partly because more often used turned up to the full. Instead, however, of condoning the absence of an oven flue, he looked forward to a more general use of an additional convenient hood arrangement to draw off the products of combustion of the boiling-rings, &c. This was unfortunately too often impossible now; but in large houses where an architect had a free hand, he really ought to make his plans so as to permit of some such contrivance—especially as the usual device of an open window might in some directions of the wind become only the fresh air inlet, and drive the heated waste gases down across the room and into the house. He lately conversed with a friend who had been induced to put a flueless heater out on the floor of a bed-room, and who was disposed lightly to wave aside as pure fancy his wife's assertion that she could not breathe with the stove alight. She was subject to bronchitis; and her symptoms and the time that elapsed before their development, plainly pointed to sulphur dioxide as being the main source of her dissatisfaction with the heater. The need of flues was, perhaps, most palpably manifest when a basement wash-kitchen had a gas-boiler which had been allowed to get corroded and made up (which perhaps more easily happened, and was more often allowed to continue, in this case than in any other). In these instances, an imperfect or non-existent flue might convince even hardened sceptics as to the need of assisting the products of combustion to escape. Most references that afternoon had been made to gas-ovens. He assumed, however, that even those who viewed with complacency the use of flueless ovens would hesitate to advocate the adoption of flueless gas-fires in ordinary rooms, though he admitted that such stoves were often very useful in some shops where flues were impracticable, and where the door was always ajar or frequently open. He did, however, remember the perfervid praise of such a flueless stove by a representative at a gas exhibition, who assured him that that type of stove had been tested in a Government office by being lit, and then all the windows and doors of the room having been closed. The stove was allowed to burn for three days and nights, at the end of which time the air of the room was as pure and good as at the beginning of the trial!

Mr. DEMAIN spoke of the experience of his works in fixing large numbers of cookers without any flues, a course which he stoutly defended. No complaints ever reached the gas-works of smells or any inconvenience arising from the absence of flues; any complaints being the usual ones due to jets being out of order and the holes in the nipples being blocked. They certainly did prefer to put flues to the very largest sizes of ovens, but regarded the expense as too serious and needless in the vast majority of cases. Flues led to the open air gave trouble in windy weather, when the jets were sometimes blown out, and flues led to chimneys ran the risk of being blocked by falls of soot. He certainly disagreed with the last speaker's demands, and urged his own experience of the absence of complaints from consumers as being quite a valid counter-plea.

Mr. CRANFIELD absolutely declined to take the absence of formal complaints against a given course as being any justification for that course, or to accept a consensus of opinion as necessarily settling the rights of that opinion. He was aware of a very general practical embodiment of the belief that no ventilation was needed for bed-rooms during the night, and that even after rising such rooms needed no special sweetening; but this did not affect his estimate of the undesirability of such practices. Similarly large numbers might be found who saw no need for baths in a house; but did their belief settle the question?

Mr. SUTCLIFFE briefly replied to the discussion, and repeated that he stood by what he had said in his paper on one or two points which had been challenged.

Mr. W. LAWSON-MITCHESON then read some

NOTES ON THE REPAIR OF A GASHOLDER.

[In connection with this paper, see the photographs and drawings in the "Journal" for May 29, 1906, pp. 580-82.]

This paper consists of a series of notes on the repair of Gasholders Nos. 3 and 4 at the Huddersfield Corporation Gas-Works, and does not aspire to be a treatise on general gasholder repairing. At the outset, I must apologize for bringing before you a subject which has been partly dealt with before; but I hope the additions I have made to the information then given will prove interesting and perhaps useful to you.

There are five gasholders at Huddersfield; their total capacity being about 3½ million cubic feet. For some time past, Holders Nos. 3 and 4, which are three-lift telescopic, with square cups and grips, had been giving trouble owing to the cups leaking water—thus making it unsafe to leave the holders fully inflated for any length of time. At first this trouble was overcome by connecting water up to the cups by means of a flexible hose and ½-inch service-pipe; but in the spring of 1905 the leaks became so pronounced as to necessitate further measures being taken.

In each case endeavours were made to find out something further about the faulty places as follows: The holder was inflated until the leaking cup was some 2 or 3 feet above the tank edge, and syphons of 1¼-inch lead pipe were then set to work to empty the water out of the cup. As soon as the water-level had sunk so far that the gas pressure could overcome the head of water, bubbles made their appearance in several cases round the cup. The syphons were stopped, and the faulty places examined so far as circumstances would permit. It was found that in several places the riveting between the shell plating and the channel-iron had given way; and also that in one of the sheets there was a crack about 14 inches long and ⅓ inch wide. In my opinion, the failure of the riveting was due to the fastening together of a thin plate (3-16 inch) and a stiff channel-iron with a virtual depth of 7 inches; the sudden change in thickness causing a fretting action which was soon accelerated by corrosion.

It was seen that no satisfactory repairs could be undertaken from the outside; and so an order was given to Messrs. Clayton, Son, and Co., Limited, of Leeds, to thoroughly examine Holder No. 3 and report. The holder was emptied, and the manhole covers loosened so that a vacuum would not form and pull the crown in, and the inlet and outlet pipes blank-flanged. A 6-inch connection from a branch in the inlet-pipe was made to an exhauster driven by a portable steam-engine. By means of this, the holder was inflated several times with air. Windows and an air-lock were fitted to the crown; and Messrs. Clayton's representatives then went inside the holder on a raft, and made a thorough examination as it was inflated. Their report confirmed our observations, with the addition that several of the dip-plates and holder-sheets were found to be in very bad condition. It was then decided to effect a thorough repair of the holder.

We now come to the repair of Holder No. 4, undertaken the following summer, and similar to that of No. 3. No. 4 is a three-lift telescopic holder of about a million cubic feet capacity. The cups are 18 inches deep, and are formed of a 7-inch by 3-inch

channel-iron and 3-16-inch plates, stiffened along the edge with a 2-inch by ½-inch half-round iron. As it was not desirable at Huddersfield to empty a holder-tank, owing to the difficulty of disposing of the water, it was necessary, in order to effect any repairs, to lift the two outer shells clear out of the tank.

The bottom curb consists of two rings of 3½ inch by 3½ inch by ½-inch angle-iron. The holder was fully inflated, and the upper one of these drilled to receive 16 equidistant 1-inch diameter U-bolts, which were inserted and securely fastened. To each of these, a pair of 10-inch by 3-inch by ½-inch plates were attached by means of 1-inch diameter bolts; and to these lifting-bars 3 inches by ½ inch by 6 ft. 6 in. long were affixed, one by one, as the holder was gradually lowered. These rods were tied up to the guide-framing by ropes until required. Lifting trestles were then placed round the holder; these supporting screws (2¼ inch diameter, 1 inch pitch, and 7 feet long), to which were fixed the top ends of the lifting-bars. The holder was grounded, the manhole covers loosened, and the inlet and outlet pipes blanked-up. The roller carriages and hand-railing were then removed from the two inner lifts.

The screws were all carefully adjusted by hand to give an equal tension, and one side of each nut chalked. Two men were then stationed at each screw; and at a given signal, each nut was turned through a complete revolution—the signal being repeated from time to time until the outer shell had been raised through one screw length. A prop was then inserted under the grip of the outer shell, opposite one screw, to support the weight while it was uncoupled, one lifting-bar removed, and the next one connected up. When each bar had been thus shortened, the lifting was continued until the outer shell had been raised 2 ft. 6 in. clear above the tank edge.

Cantilevers were then placed under the bottom curb. Ear-plates of ½-inch steel were attached to the top grip; and to these were fixed chains, passing round the columns of the guide-framing. The chains were tightened up by means of right and left hand screw couplings. When the outer lift had been thus secured, the screws were uncoupled, and the top bars of the trestles lifted up and fastened across the first tier of the girders and the top grip of the outer shell. From these the screws were arranged for lifting the second shell. As it was impossible to fix ear-plates to the second shell on account of its position in the tank, it was necessary to lift it at first by means of hooks placed round the dip-plates. When the lifting had been carried far enough to allow of it, ear-plates were attached, and the lifting proceeded from these. The lifting went on until the shell was about 1 foot clear of the water. Then short pieces of 9-inch by 3-inch timbers were put under it, spanning the space between the inner lift and the tank edge. For safety, the shell was lowered on to these.

The sheeting was carefully examined, and it was found necessary to renew the bottom ring of plates, several of the cup-plates, and one length of the channel-iron. The plates to be removed were numbered consecutively, and cut out, leaving at first, however, every third plate, in order to retain the relative positions of the parts. The old plates were dispatched to Messrs. Clayton's works, and new ones made to the same sizes. When these arrived, they were riveted into position, and the rest of the old plates cut out and renewed in the same way. When complete, the new cup was tested for water-tightness, and found satisfactory. It was then painted.

As the grip of the outer shell had to support the weight of the inner one during lowering, no plates were cut out of it until the latter had been lowered into the tank. As it was lowered, the sides were examined; all faulty places being repaired. The holes where the ear-plates had been fastened on were filled with set-screws, and the heads riveted over. The work of renewing the plates in the outer shell was next proceeded with; and when finished, the lifting-trestles were rigged up again, and the shell lowered into place. One man to each screw was found sufficient for the lowering.

When both lifts were down, the roller-carriages were replaced and adjusted. Windows and an air-lock were fitted to the crown, and the holder re-inflated with air. The U-bolts and lifting-bars were removed from the bottom curb, and then men were sent inside on a raft to make a final examination and to adjust the inner guide-rollers.

Some care is needed when working inside a gasholder, as the tank-water contains about 7 per cent. by volume of dissolved gases. The tank in question was filled with more than 2,000,000 gallons of water, which had dissolved in it about 24,000 cubic feet of gas. A sudden fall in the barometer, or a sudden rise in temperature causes a good deal of this gas to be given off into the air. Gases are also freely given off when the water is agitated by a holder cupping. On this account, it was thought best to station a man in the air-lock to keep an eye on those inside, and get them out if they showed any signs of fatigue.

When the holder was once more grounded, the windows and air-lock were removed and the crown made good. The holder was then filled with gas, and received its due coat of paint. The total time occupied in the repair of Holder No. 4 was twelve weeks; and the only accident that occurred was that one of Messrs. Clayton's apprentices fell into the tank, and was fished out soaking wet. The cost of the repairs was: Holder No. 3, £811; and Holder No. 4, £652.

The paper was illustrated by a series of lantern slides. The subject naturally did not invite formal discussion; but a number of questions were asked and answered. Mr. Lang and others referred to the precautions taken to ensure even lifting by uniform turning of the screws, and pointed out how a sharp and experienced workman, finding himself next to a "green" one, could contrive, by getting half-a-turn ahead or behind, to throw most of his share of the lifting on to his companion. It was pointed out that, by putting the old hands alternately with new ones, even if this device was adopted, the holder would still rise or fall evenly, though the burden of the work would be unevenly distributed. Mr. Demain quoted an experience at his works where a Gadd and Mason holder was being built up, and one man giving two or three extra turns to his screw threw the weight so unevenly that the cup and the sheets that had been attached all broke loose and fell into the tank. This involved the contractors in considerable expense.

The readers of the papers were heartily thanked.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

The members of this Association met in the Municipal School of Technology, Manchester, on Saturday afternoon—Mr. R. H. GINMAN in the chair.

The PRESIDENT, in opening the meeting, welcomed several new members of the Association.

Mr. L. D. MOSLEY, the Assistant-Engineer of the Stretford Gas Gas Company, read the following paper:—

SOME RESULTS OF LOW-PRESSURE INCANDESCENT STREET LIGHTING.

In January, 1904, the Stretford Gas Company placed a scheme before one of the Urban District Councils in their area for an improved lighting of the district controlled by the Council; the scheme embodying the substitution of the incandescent system for that of the flat-flame burners then existing. The Company had for some months maintained, at their own expense, a few incandescent lamps in this particular district, in order to show their superiority over the flat-flame system. The scheme was adopted; and I propose to give an account of how the work was carried out, and of the lighting results of the past two seasons.

Under the agreement, the Company had to supply and erect the necessary lanterns, burners, &c., and maintain them for a fixed charge per lamp for a period of five years (the price to cover the repairs of lanterns, burners, renewals of mantles, protectors, &c.), to paint the pillars with one coat of paint per year, and to pay all expenses of lighting, cleaning, &c. The number of hours for which the lamps should be lighted was to be 1750 or thereabouts; giving a lighting period of 40 weeks per annum. The price to be paid by the Council to the Company for dismantling the old system and the providing and erecting of the new lanterns, was £420; this amount being paid to the Company in five equal annual instalments of £84 each, *plus* interest. The number of lamps in the area was 187; and 186 of them had to be fitted with low-pressure burners—the remaining one with some form of self-intensifying burner. The distance of the lamps apart was from 60 to 80 yards. The area is a suburban one; and the roads are narrow and winding.

As the Council desired that the existing pillars, which are very light in section, should be used, it was necessary that they should be made as rigid as possible. This was done by encasing the foot of each pillar with concrete. The service-pipe to each lamp was carefully examined and renewed where necessary; and in all cases it was well packed, to prevent sagging. The upright services were renewed, and the end was made secure by passing it through a piece of ¾-inch hydraulic tube secured to a cast-iron bobbin; the hydraulic tube being held securely in position by means of two set-screws fixed through the sides of the column. The concreting of the base and the packing of the uprights were done to ensure as much rigidity as possible. I consider that too much attention cannot be paid to these items.

The lantern was fixed to a frog, which in turn was attached by set-screws to the bobbin already mentioned; thus giving the whole as much stability as was possible. The type of lantern adopted was that known as the 14-inch "Windsor." It is made of copper, and fitted with enamelled steel convex reflectors and chimney; also with steel rods to the body ribs, ball-trap door, and wrought-iron frog. The burner adopted was the No. 3 Sugg, fixed on an anti-vibrating frame; the burner being lighted by the Simmance-Abady flash-torch. Each burner is fitted with a Sugg governor, regulated to pass 3½ cubic feet of gas per hour (except the high-pressure burner), tested at a pressure of 25-10ths. The usual system of supplying gas to the public-lamps is on the average meter system; there being one meter to every ten lamps in the Council's district.

The number of lamplighters employed is three; and their duty is to light and extinguish the lights and keep the lanterns in a proper condition, so as to satisfy the requirements of the Company's Engineer and the Council's Surveyor. Each lamplighter is supplied with lighting cards, upon which he books the time of lighting and extinguishing and any necessary repairs. These cards are handed in each morning, so that any repairs or renewals may receive prompt attention. The renewals, &c., are entered in a record-book.

The following statistical and other particulars in regard to the scheme will be of interest:—

First Year's Returns.

556 mantles, No. 3 . .				By amount received—		
21 ,, (h.p.) . .	£8	6	4	Half year ending Dec., 1904 . . .	£191	15 3
61 protectors . . .				Half year ending June, 1905 . . .	163	15 1
19 rods						
Lighting, wages, and superintendence . .	160	19	7			
Gas	139	2	8			
Materials and repairs .	19	16	9			
Clothing, torches, plates	14	0	5			
Balance	13	4	7			
	£355	10	4		£355	10 4

NOTES.

December half year—
186 lamps burning 950 hours, at 37s. 3d. } Per lamp for 1750 hours.
1 lamp ,, ,, ,, 99s. 6d. } Per lamp for 1750 hours.
1 ,, ,, 693¼ ,, ,, 37s. 3d. } Per lamp for 1750 hours.

June half year—
190 lamps burning 808¾ hours, at 36s. 9d. } Per lamp for 1750 hours.
1 lamp ,, ,, ,, 98s. 0d. } Per lamp for 1750 hours.
1 ,, ,, 368½ ,, ,, 36s. 9d. } Per lamp for 1750 hours.

Gas consumed in low-pressure lamps . . 1,139,318 cubic feet.
Do. per lamp . . . . . 3·44 c. ft. per hour.

Second Year's Returns.

723 mantles No. 3 . .				By amount received—		
33 ,, (h.p.) . .	£11	0	8	Half year ending Dec., 1905 . . .	£194	3 6
79 protectors . . .				Half year ending June, 1906 . . .	174	1 6
43 rods						
Lighting, wages, and superintendence . .	167	13	8			
Gas	138	11	2			
Materials and repairs .	14	19	0			
Clothing	5	7	9			
Balance	30	12	9			
	£368	5	0		£368	5 0

NOTES.

December half year—
191 lamps burning 934½ hours, at 36s. 9d. } Per lamp for 1750 hours.
1 lamp ,, 934½ ,, ,, 98s. 0d. } Per lamp for 1750 hours.
7 lamps ,, 3938½ ,, ,, 36s. 9d. } Per lamp for 1750 hours.

June half year—
198 lamps burning 824 hours, at 36s. 9d. } Per lamp for 1750 hours.
1 lamp ,, 824 ,, ,, 98s. 0d. } Per lamp for 1750 hours.
1 ,, ,, 552¾ ,, ,, 36s. 9d. } Per lamp for 1750 hours.

Gas consumed in low-pressure lamps . . 1,157,391 cubic feet.
Do. per lamp . . . . . 3·34 c. ft. per hour.

Mantle Account per Lamp per Annum.

	Year Ending June 30, 1905.		Year Ending June 30, 1906.
Mantles	3·80	..	4·70
Protectors	0·42	..	0·52
Rods	0·13	..	0·28

The materials employed in conjunction with the lighting are the best of their respective kinds. The mantles now used, particulars of which have been given as regards consumption, were subjected to severe trials before being adopted for the lighting of the district.

The methods adopted for the supervision, lighting, and maintenance, are as follows: The lanterns are cleaned once a week, and, in any case, they must be clean for the week-end. Each lamplighter is provided with a brush for cleaning the burners, nipples, &c., so that the burners may always be at their highest efficiency; but the Company have no agreement to give a stated candle power, as, I believe, is the case in some places. No mantles are allowed to become defective (in fact, it does not pay, with mantles at present prices, and every broken mantle exposed to the public view is not a good advertisement for the use of gas as an illuminant); instructions being given to the lamplighters that if any badly damaged mantles are found when they are on the lighting round they are to be replaced by new ones the same night. These rules are strictly adhered to, for it is only by keen inspection and careful attention that efficient lighting can be obtained. The lamps are inspected at least once per week (no special day being set apart), Sunday included, by the chief fitter in the Maintenance Department; and as the lamplighters are under the care of the Mains Department, the official in charge sees that the lanterns are clean and that the burner is kept up to the required standard of efficiency. At the end of the lighting season, the burners are taken out of the lanterns and thoroughly cleaned, and any defective parts renewed; the governors are tested or renewed, as the case may be; and everything is got in order for the next season.

As previously stated, I attribute the successful results obtained to be due to the columns, service-pipes, and lanterns being properly fixed, and particularly to the base of the columns being made as rigid as possible. I have abstracted the mantle account for 26 lamps in this lighting area situated in a portion of the main road from Manchester to Chester, on which there is a very large amount of traffic. A census taken for the seven days (of 24 hours each) ending Oct. 17, 1904, shows that 16,668 vehicles passed a given point on the road; the number being made up as follows: 2862 lorries and carts, 4038 traps and other vehicles, 561 motors, and 9207 cycles, motor cycles, &c.—an average of 2381 per diem. This number has since largely increased. The Corporation of Manchester now run a car service through the district; and, in addition, there is also a heavy increase in motor traffic, both of the heavy and the light type. The number of mantles used on the 26 lamps during the past season has been 67; equalling 87 in twelve months. This gives an average of 3·3 mantles per lamp per annum, which, considering the traffic, will be hard to beat. As a contrast to this, and to show the point I wish to put before you, eleven lanterns were fixed in another area, on columns of which the bases had not been made rigid. The type of lantern used was the Welsbach open-flap, fitted with governor burner and anti-vibrating frame. The mantle account for these lamps averaged 11·6 per lamp per annum.

There are six bracket lamps in the area. They stand out from the wall a distance of from 1 ft. 6 in. to 2 ft. 6 in. The mantle account for these lamps averages 4 per lamp per annum. Mr. S. Meunier, of Stockport, in a paper on the subject of "Incandescent Lighting and Maintenance," read before the Manchester District Institution of Gas Engineers on Nov. 28, 1903, suggested that bracket lamps should be more employed. He gave two tables showing the mantle accounts for the twelve best and the twelve worst lamps in his district.* Of the best lamps, two were bracket lamps with a consumption of 4 mantles per lamp per annum; six were lamps fixed away from the kerb on dwarf walls, &c., and had a consumption of 3·5 mantles; and the remaining four were pillar lamps, with a consumption of 4 mantles. The worst lamps were all pillar lamps, with a consumption of 15·5 mantles each per annum. The tables showed that, unless special precautions are taken, the pillar lamps are more expensive in renewals.

As to the use of inverted burners for street lighting, several have been tried in this area; the burner being fixed well up in the lantern, and fitted with an opaline globe. The light given is well diffused and very effective; but the mantle account is in excess of that for the vertical type, it being at the rate of 5·3 mantles per lamp per annum. I attribute this excess to the fact that this type of burner requires more attention in lighting.

Discussion.

Mr. R. H. GARLICK (Salford), commenting upon the "returns" furnished by the author of the paper, expressed the opinion that the results attained, on the whole, were excellent. The number of mantles per lamp for the year ending June 30, 1905 (3·80) was very satisfactory. It was evident that the supporting columns should be made as rigid as possible. This was a point which had been brought forward in the Swinton district. They had 103 lamps going all the year round; but the heavy traffic on some of the roads was very noticeable, and the vibration was consequently considerable. He thought the time had not yet arrived for the production of a really effective lamp for lighting. What was wanted was a perfect lamp; and here there was an opening for the inventor. He had been struck with the record of the bracket lamps, and he believed that sufficient attention had not been given to the vertical burners. He should be able to take to heart the information Mr. Mosley had given; and he trusted it would be an incentive to others to come forward and read papers on the same subject.

Mr. A. L. HOLTON (the Secretary of the Association) considered the second year's returns showed a rather serious increase in cost; and he said he should like to hear Mr. Mosley's opinion upon them.

Mr. D. V. HOLLINGWORTH (Salford) complimented Mr. Mosley on the transparent honesty of his paper. In future work of the kind, the members of the Association would have the benefit of his experience. He (Mr. Hollingworth) was, however, struck with the number of mantles used per annum, which he considered to be abnormal. He should like to be favoured with the total cost before the conversion. The cost of the incandescent lighting for the first year was £355 10s. 4d.; while in the second year it had risen to £368 5s. The repayment to the Company, he observed, was to be spread over five years.

Mr. SHAW (Darwen) noticed by the paper that the number of lamplighters was three, and they had to keep the lamps in proper condition. The number of mantles used at high pressure struck him as being rather large.

Mr. C. E. TEASDALE (Salford) remarked that the distance of the lamps from each other had been given as from 60 to 80 yards. This seemed a great distance on a main road. Was it measured by the kerb, by the centre of the road, or diagonally? At such a distance from each other, he should not consider the lighting could be efficient.

The PRESIDENT said the burners employed were of an excellent type; but there were others, one of which could be used without a governor. There were some governors which had no means of regulation. As to the automatic lighting and extinguishing of public lamps, in his opinion the cost of the appliances almost put them out of court.

Mr. MOSLEY, replying to the various observations, contrasted the cost of mantles at Stretford with Wakefield and other places, and said he thought, considering the efficiency kept up, that the Stretford returns bore very favourable comparison. He went through the streets night after night, and out of 104 lamps found only one bad mantle. They had good lamplighters, and this was everything. As to the extra cost on the second year, it was accounted for by a long stretch of the main road being concreted

* See "JOURNAL," Vol. LXXXIV., p. 542.

or tramlines. A considerable number of lamps had to be taken down, and this caused damage. The cost per annum of the old system before conversion was £434 for 1750 hours' burning. They had now better lighting at much less expense. The reason for extending the payments to the Company over five years was to lessen the rates. In one district that he mentioned, the repayment for conversion had extended over ten years. The cost of high-pressure lamps would be reduced if more perfect rigidity could be obtained. It had been found that some breakages occurred through the flames impinging upon the mantles. With regard to the distance of the lamps from each other, the actual space was 35 yards, as there were lamps both sides of the road.

The PRESIDENT observed that in his district, after a recent storm, 150 out of 300 lamps had no light—(laughter)—but they had not yet secured rigidity in their system, their lights hanging loose in a cradle at the top.

Mr. MOSLEY then gave some practical illustrations of automatic gas-burners.

On the motion of Mr. OLDFIELD (Denton), seconded by Mr. BRADDOCK (Radcliffe), a vote of thanks was accorded to the reader of the paper. Mr. Braddock mentioned that in his district they had nothing to do but supply the gas. After a recent gale, he found not one decent mantle in every dozen.

The resolution was carried with applause.

Mr. MOSLEY having briefly acknowledged the compliment, the meeting terminated.

Gas-Driven Warships and Liners.

The subject of the use of gas for marine propulsion, even in the case of large warships, came forward rather prominently toward the close of last week. News reached England from New York on Friday that Mr. Lewis Nixon, the well-known marine architect, who has designed several ships for the American Navy, has obtained patents for an engine which he believes will reduce the voyage across the Atlantic to four days. It is of standard type, and the motive power is supplied by gas obtained from crude petroleum. He explains that the first vessel designed by him to cross the Atlantic in four days by means of his improved gas-engines will be a torpedo-boat destroyer of 650 tons and of 12,000 H.P. It will be able to maintain a continuous speed of 30 knots, with a maximum speed of 33 knots per hour; and her machinery will weigh only 210 tons. At the meeting of the Royal Institute of Naval Architects on the same day, Professor Lewes read a paper on "Some Phases of the Fuel Question," in the course of which he stated that we seem to be on the eve of a period of rivalry between the marine engine and turbine on the one hand, and the oil and gas engine on the other. He said there was no gainsaying the unqualified success of the petrol motor-boat, while the labours of Capitaine and others had now made suction plant and the gas-engine a possibility; and it was stated that the oil-engine, using heavier grades of oil than petrol, would soon be employed for marine propulsion. Interviewed by a representative of "The Tribune" on the subject of Mr. Nixon's new gas-engine, Professor Lewes stated that, from his familiarity with the experiments that had for some time been taking place, he had no doubt that the propellant used would not be crude petroleum, but petroleum from which the petrol had been extracted—leaving an oil with a flash-point of not less than 150° Fahr. as the fuel used. He added that he was personally well acquainted with Mr. Nixon, and he only hoped that the report of his successful solution of the problem was correct, as if by this means, with oils of a safe flash-point, 12,000 H.P. could be obtained, there was no reason why the power necessary for the largest Atlantic liners and war vessels should not be within reach, and an entirely new era thus created.

New Earth-Boring Tools.—In carrying out excavation or well-sinking work, trial holes are generally necessary, in order to ascertain the nature of the ground. An attempt has been made by Herr H. Meyer, of Hanover, to supersede the appliances generally used by the introduction of a set of three implements which he calls "earth augers." With the first, which is named the "Triumph," the inventor claims that two workmen can in three hours bore in loamy and clayey soil a hole 4 inches in diameter and 30 feet deep. The second—the two-edged cylinder auger—is specially adapted for boring in rich soils, sand, gravel, &c., and is chiefly employed where the holes have an unusually large diameter, up to 24 inches. The third, on account of the varied uses to which it may be put, is called the "Universal" auger. It is constructed cylindrically, and provided with a slot capable of being closed on the side, and a valve-box, which can be screwed on and off. This innovation admits of boring in dry soil, in clay, loam, gravel, sand, brown coal, &c., without closing either the slot or the valve. In boggy land, however, the slot can be closed by a slider, and the valve screwed on. In the latter condition the cylinder becomes full by simple rotation. When lifting the apparatus, the valve closes of itself, and the contents of the cylinder are brought up safely to the surface. Owing to the particular position of the two edges, the auger does not become fixed in the ground, but cuts itself free, and therefore can be raised easily. The borer can, according to its size, raise stones 8 inches in diameter.

VALUATION OF GAS OILS.

A recent issue of the "Journal für Gasbeleuchtung" contains an article by Dr. A. Spiegel, in which the author discusses the methods hitherto available for estimating the value of oils employed either in the manufacture of oil gas or the preparation of carburetted water gas, and finally describes a plan which he believes will prove of some assistance to gas engineers in ascertaining more particularly the value of such oils as carburetting agents.

In the first place, the author mentions that none of the common tests for ascertaining the value of gas oil given by Lunge and other writers affords any direct information as to the practical or carburetting value of the material. For example, it is not the calorific value of an oil which makes it useful in the preparation of carburetted water gas, but rather the amount of heat which the cracked oil adds to the water gas. Naphthalene is practically devoid of carburetting value, although it possesses a calorific power only a little lower than that of paraffin oil—equal, indeed, to those of stearic and oleic acids, both of which are very valuable substances. Again, the calorific value of an oil is greatly reduced by the amount of oxygen it contains; but the latter constituent does not diminish its carburetting value. The normal mineral oils available at the present time also contain oxygen in the form of fatty esters and alcohols, which are valuable when the oil is gasified. Their existence, however, in an oil required for carburetting purposes leads to errors when the material is examined by ordinary methods, as they increase the specific gravity and decrease the calorific power, although they are as useless as creosote in the manufacture of carburetted water gas.

In view of these circumstances, many gas engineers refrain from examining an oil according to the usual methods, preferring to estimate its value from the results obtained on heating it in a retort so as to obtain an oil gas. Now, the gas oils of commerce have no intrinsic carburetting value, because none of them are sufficiently volatile to be taken up by cold gas. When exposed to heat they are partially converted into gaseous bodies and liquid substances of low boiling point, which remain suspended in the gas; and, according to the temperature employed, the amount of cracking of the oil varies until, if the heat is pushed to a sufficient point, the decomposition is so far-reaching that only free carbon and hydrogen are produced, and the amount of light-yielding material falls to zero. Hence a plan has been adopted —as, for instance, in the Peebles process—of running a gas oil into a retort having a large heating surface but maintained at so low a temperature that the gasification of the oil remains incomplete; the uncracked oil being then mixed with fresh oil and introduced again into the retort until the whole is decomposed. The ordinary oil-gas retort, on the other hand, possesses a comparatively small heating surface, and it therefore has to be raised to so high a temperature that the cracking of the oil goes too far. It is well-known that the lower the retort temperature the smaller is the make of oil gas, but the higher is its candle power; whereas the mathematical product obtained on multiplying the make by the candle power attains a maximum at a certain mean temperature which varies with different oils gasified in retorts of the usual type. The amount of candle power that can be obtained per unit weight of oil cracked depends upon the method employed for the cracking of it; and quite roughly speaking it may be said to be (quoted in Hefners per 100 kilos) 19,000 in the ordinary process of oil-gas manufacture, 25,000 in the Peebles process, and 30,000 when the oil is used to make carburetted water gas.

The greater amount of candle power obtained from the oil when the latter is used to prepare carburetted water gas, is due to several causes. (1) In carburetted water gas the carbon of the oil gas which yields the light is developed within a flame of hydrogen coming from the water gas, whereas in an oil-gas flame the hydrogen comes from the oil gas itself, and waste occurs. (2) A larger volume of gas is made when the oil is used for carburetting purposes, and, therefore, the more volatile liquid hydrocarbons are not so liable to be deposited as when the oil is used to make oil gas. (3) The carburettor is a vessel of extensive heating surface, so that the oil is heated without being raised to an excessive temperature. (4) The hydrogen of the water gas may also act beneficially, either by altering the equilibrium so that less of the oil is decomposed into free graphite and hydrogen, or by retaining in the gas as methane substances which would otherwise pass into the tar—as Sabatier and Senderens have shown to be the case when benzene is heated with hydrogen. Doubtless these four reasons for the increased yield of candle power from oil when employed to make carburetted water gas differ in relative importance according to the nature of the oil and the extent of the carburation.

The process recently described by Ross and Leather, which consists in gasifying an oil in a model retort, is undoubtedly the most correct of such processes. Objections may be urged against it, that it does not show the full effect of the polymethylenes which Haber has shown to be probably present, or of the homologues of methane which Graefe has proved to be always present in the gas. But in the hands of Messrs. Ross and Leather it has given results agreeing so well with those obtained during the manufacture of carburetted water gas that it must be considered of very great utility. It is distinctly to be preferred before the

Kind of Oil.	Specific Gravity.	Iodine Value.	O + S + N. Per Cent.	C. Per Cent.	H. Per Cent.	"X." Per Cent.	10X.	Carburetting Value: 10X × 15 + 250 pf. Marks per 100 kilos.
Anthracene oil, crude	1·097/21°	63·4	3·49	89·76	6·75	..	..	..
,, free from c eosote and bases	1·092/19°	28·3	2·21	91·15	6·64	..	..	..
Creosote oil ,, ,, ,,	1·036/21°	29·0	1·83	90·92	7·25	0 25	2	2·80
Benzol, theory	0·879/20°	0·0	0·00	92·30	7·70	..	..	..
Petroleum distillate, extra-European	0·955/18°	11·6	3·24	85·83	10·93	3·93	39	8·35
Paraffin oil, European, distilled (1)	0·909/21°	51·4	3·07	86·00	10·93	3·93	39	8·35
,, ,, ,, (2)	0·885/19°	77·9	2·84	85·37	11·79	4·79	48	9·70
,, ,, ,, (3)	0·867/19°	49·3	3·05	84·92	12·03	5·03	50	10·00
Petroleum distillate, European	0·886/15°	29·8	1·82	85·85	12·33	5·33	53	10·45
,, ,, extra-European	0·857/18°	22·8	1·15	85·81	13·04	6·04	60	11·50
"Paraffinum Liquidum"	0·878/21°	0·0	1·32	85·20	13·48	6·48	65	12·25
Lamp oil, Russian	0·819/19°	1·0	..	..	..	..	..	..
,, American	0·798/20°	16·8	0·06	85·74	14·20	7·20	72	13·30
Undecane, theory	0·741/20°	0·0	0·00	84·61	15·39	8·39	84	15·10

Wernecke-Helfers process, when an oil is to be examined as to its suitability for oil-gas preparation. The Wernecke apparatus has certainly proved valuable to the chemist in studying the process of oil gasification, enabling Eisenlohr to demonstrate that, in spite of earlier beliefs to the contrary, there is no objection to mixing oils of different boiling points, that oils rich in paraffins give a higher amount of candle power than such as are poor in paraffins, that the yield of gas is the smaller the less completely saturated are the hydrocarbons in the gas, and that there is very little to be said against using an oil of high boiling point. According to Lunge, it is important to estimate the proportion of hydrocarbons soluble in strong sulphuric acid, and to submit the gas oil to a distillation test, because a high proportion of unsaturated hydrocarbons and of matter boiling above 300° C., is prejudicial. Eisenlohr's results sufficiently proclaim the incorrectness of the last requirement; while the first is opposed by the observations of Engler and Jezioranski, who have shown that many petroleum residues are almost entirely soluble in strong sulphuric acid, although they differ considerably in carburetting value. Moreover, Graefe's notion, that the lower the iodine value of an oil the better it is for gas-making purposes, is rendered untrustworthy, because the aromatic hydrocarbons found in many oils do not combine with iodine, so that an oil containing them appears improved, instead of being injured through their presence.

What has been said above, coupled with the statements collected in Scheithauer's valuable book on mineral oils, tends to show that an oil is the more valuable the more nearly saturated its hydrocarbons are—that is to say, the more hydrogen it contains. On this basis, Dr. Spiegel has elaborated a method for estimating the practical value of a gas oil. It consists in determining the proportion of hydrogen in it by the ordinary process of ultimate analysis. The proportion of hydrogen in different oils varies largely, being smallest in the oils of coal tar and highest in the aliphatic paraffins—especially the undecane synthetically prepared by Ross and Leather to which those authors ascribe the highest carburetting value—whereas that of anthracene oil, for example, is practically zero. In the above table are collected analytical and other details of various oils which may be employed for gas manufacture.

Inasmuch as the hydrogen present in the coal-tar oil possesses no carburetting value, only that portion of the substance which remains in the form of tar is of any use. The lower the carburetting value of an oil the more tar it yields, and *vice versâ*. Even the best oil leaves some tar as a bye-product when employed for carburetting water gas, but leaves much less than a coal-tar oil. It may be said that a suitable coal-tar oil contains on an average 7 per cent. of hydrogen. When a gas oil very rich in hydrogen is employed, more than the excess of hydrogen over the above-mentioned 7 per cent. enters in a useful form into the gas, so that less than the 7 per cent. remains with the tar; and it may be argued that the extra amount of gas so produced from oil of the best quality over the normal amount obtained from inferior oils finds its equivalent in a smaller production of tar. Hence the author's plan for attempting to calculate from laboratory data the pecuniary value of an oil used for the manufacture of carburetted water gas is based on ascribing to the oil itself a certain fixed monetary value, multiplying the amount of hydrogen in the oil in excess (x) of 7 per cent. by 10—*i.e.*, expressing the said excess in parts per thousand—ascribing to each part per thousand of hydrogen a second fixed monetary value, and adding the two different items together. For example, taking the undecane mentioned in the last line of the table, the total proportion of hydrogen is 15·39 per cent., x being therefore equal to 8·39 and $10x$ to 84. If, now, the fictitious value of 250 pf. per 100 kilos is taken as the standard price for the oil itself (p), and the value of each part per thousand of available hydrogen is taken at 15 pf., the total carburetting value of undecane becomes $250 + (84 \times 15) = 1510$ pf., or 15·10 marks per 100 kilos.; whereas the value of the creosote oil in the third line of the table, which contains only two parts per thousand of hydrogen over the normal 7 per cent., is on similar lines made to be $250 + (15 \times 2) = 2{\cdot}80$ marks per 100 kilos. It is to be distinctly understood that this method of calculation is applicable only to the heavy oils used for carburetting water gas by the hot process, and not to those volatile spirits which are employed in the cold; also that the two different prices used in calculating the values must be so selected as to suit local conditions. In the table they are quoted according to the German practice in pfennige per 100 kilos. In England they would have to be given in shillings per cwt. The figures regarding the iodine values of the different oils amply prove that the constant bears no relationship to the practical value of the material as a means for carburetting water gas.

Dr. Spiegel's method has been applied satisfactorily for calculating the carburetting value of the oils recently employed by Dr. Leybold for the manufacture of carburetted water gas at the Brussels works. Still, it may be objected that the number of samples hitherto examined is too small to show whether or not the method is universally applicable. The author himself feels that more study of the subject is needed, especially with regard to the judiciousness of taking the figure 7 for the normal proportion of hydrogen which possesses no carburetting value, as he has done for purely theoretical reasons. Further experiments are certainly required in order that the method may be compared with the results obtained when the oils are used on a large scale. It is doubtful, however, whether the comparison can be directly made against ordinary manufacturing results. To do so would prove expensive and tedious, and, moreover, the results would be vitiated by the difficulty of maintaining uniform and standard conditions in a large carburettor, and of ascertaining the true mean calorific value of the gas owing to the differences in its composition at different stages of the manufacturing operation. For these reasons Dr. Spiegel believes that his method of calculation ought to be compared against the figures given on making carburetted water gas on a laboratory scale, where, with the aid of electric heat and a thermo-couple, the process can be carried out at a predetermined temperature and speed, and where the calorific power of the carburetted water gas (which is a more important factor than its illuminating power) can be measured accurately. Working on a laboratory scale, too, with the aid of a gas contained under pressure in a cylinder, investigations can be made into the effect produced by carburetting pure hydrogen, or pure carbon monoxide, and upon the influence exerted by varying proportions of carbon dioxide in the latter. The electrically-heated carburettor would also throw light upon the question whether the increased yield which can be obtained by increasing the temperature may not also be obtained in a shorter time by increasing the heating surface.

Naturally, the absolute carburetting power of any oil would be best determined by measuring the number of heat units added to water gas by the decomposition of unit weight of gas oil; and such a method of examination would be preferable to the arithmetical process suggested by Dr. Spiegel, were it not for the fact that facilities for carrying out ultimate analyses are present in every laboratory, whereas the apparatus required for the calorimetric estimation is less commonly at hand. Moreover, the direct method would not give accurate results as to the proper price of a gas oil unless corrections were made for variations in the quality of the tar. Nevertheless, it must be remembered that the arithmetical method would lead to mistakes if gas oils were to appear on the markets which contained an appreciable quantity of any substance having the character of decahydronaphthalene. This body contains 13 per cent. of hydrogen, and therefore is made by Dr. Spiegel's method to appear a very valuable carburetting agent, although, as Leroux has shown, it decomposes at a red heat into hydrogen and naphthalene, which are altogether devoid of carburetting value.

The Institution of Gas Engineers and Methods of Carbonization.—A circular has been issued by the Secretary of the Institution (Mr. Walter T. Dunn), informing the members that, in connection with the Special Purposes Fund, a Sub-Committee consisting of Messrs. Thomas Glover, S. Y. Shoubridge, and A. E. Broadberry, has been appointed to investigate and report on any methods of carbonizing likely, in a noted degree, to increase the value of gaseous and residual products from coal, or in other ways to reduce costs of manufacture. The members are asked, if any instances of exceptional results worthy of consideration have come under their notice, to furnish particulars of them. The hearty co-operation of all members of the Institution is invited; it being hoped in this way to obtain information which may be of great value to the gas industry.

REGISTER OF PATENTS.

Charging Retorts, Furnaces, &c.

QUENEAU, A. L. J., of South Bethlehem, Penn., U.S.A.

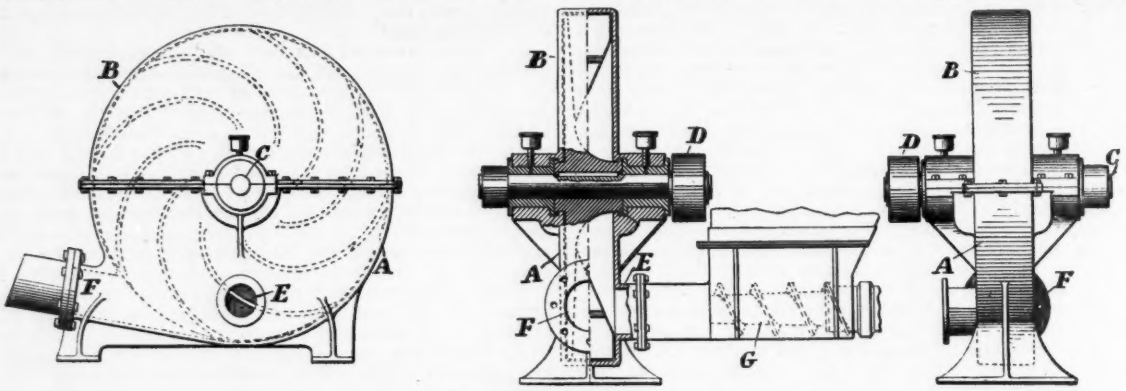
No. 1101; Jan. 15, 1906. Date claimed under International Convention, Jan. 16, 1905.

This charging machine comprises an enclosing casing, a rotary shaft, a series of impact blades, an inlet for feeding the material to be charged into the path of movement of the outer ends of the blades, feeding mechanism arranged in the inlet and terminating in advance of its discharge mouth (thereby serving as a seal against the admission of air with the charging material), and a tangential outlet.

The casing of the machine is made up of a base casting A and a top casting B, provided with projecting flanges for bolting them together. Between the two is journaled the shaft C (adapted to be revolved by the drive pulley D), upon which is keyed an "impeller disc," consisting preferably of a single casting having a hub portion with end flanges, a flat main body portion (constituting a circular plate corresponding in diameter to the internal diameter of the casing), and a series of curved blades. At their outer ends, the blades are of a width corresponding to that of the casing, and then continue of this width to a radial distance corresponding to the lower portion of the feed inlet E, from which point they decrease in width until they merge into the surface of the disc. Thus any material forced into the casing through the opening E will receive the full impact blow of the extreme outer portion of the blade approaching at that particular instant, and, dropping in front of the widest and outermost portion of the blade, and at right angles to it, will have imparted to it a momentum equivalent to that due to a sharp blow. In consequence, the material will be driven out tangentially through the upwardly inclined outlet spout F. The function of the extension of the pipe F is to give form and direction to the issuing stream of charging material; and, in this regard, it "acts, in a measure, like the barrel of a gun, to insure against scattering of the projected particles." In some instances, if desired, a forked pipe section may be employed, so as to simultaneously charge two or more vessels at one and the same time.

In practice, says the patentee, the material supplied to the charging machine would be fed, from a hopper, into the inlet opening E, by means of a feed-screw G, delivering into a pipe bolted to the inlet pipe E, so that the charging machine will be thus supplied with a forced feed, which may be so regulated as to correspond exactly to the conditions of use, and particularly to the speed of revolution desired.

The speed of revolution of the "impeller disc," and the speed of revolution of the conveyor screw, are so adjusted with respect to each other as to furnish "a resultant stream of material corresponding to the particular requirements of use." In practice, the patentee says he has produced a stream of material, which, shot through the outlet, travels in a straight path, without any material spreading, for a distance varying from 3 to 10 feet and more—the charge moving in a practically



Queneau's Retort-Charger.

solid, homogeneous column, of generally cylindrical form, so that it can be directed into a retort or muffle opening of small diameter. The obtaining of this non-spreading, solid and homogeneous column, is due, in great measure, to the fact that the casing is sealed, at all times, by the material fed into it, so that practically no air can enter with the material into the casing. The feed screw G (as will be seen) terminates in advance of the discharge mouth of the inlet—thereby leaving an intervening portion, which is constantly packed full of the material, and which remains full whether the feed screw is in operation or not. "There is, therefore, no indraft of air into the casing, and the column of material which issues through the tangential discharge spout is practically devoid of air. If air were present, as an element of the column projected from the tangential discharge spout, it would tend to expand and scatter the material on its way to the retorts, and the air within the retorts would itself oppose such resistance to the entrance of a column of material containing air, that additional scattering would take place at the retort mouths."

Discharging Coke from, and Charging Coal into, Gas-Retorts.

FIDDES, W. W., of Bristol, and ALDRIDGE, J. G. W., of Victoria Street, Westminster.

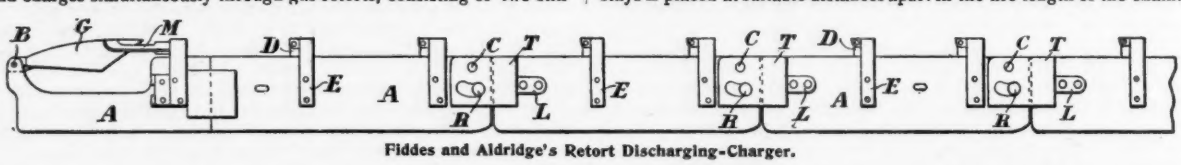
No. 5375; March 5, 1906.

This invention relates more especially to apparatus that discharges and charges simultaneously through gas-retorts, consisting of two stiff or jointed side pieces held together by distance-pieces and having swinging push-plates adapted to push the coal from a movable bed plate outside the retort directly on to and along the bottom of the retort while the front end is pushing out the coke—the coal being automatically supplied to the bed plate in the desired quantity as the charger advances into the retort. It has for its object (1) to level the surface of the deposited coal and to prevent coal being withdrawn from the retort during the return stroke of the discharging-charger, by means of a reverse plough fixed rearwards on the front push-plate at a suitable height; (2) to balance or hinge the divisional plates so that they bear only lightly on the coal on the return stroke; and (3) to drive the chain or jointed sides of a jointed discharging-charger by means of notches cut in the sides or slight projections on the chain and corresponding projections on the wheel on which the jointed discharging-charger is wound—thus reducing as much as possible all internal projections.

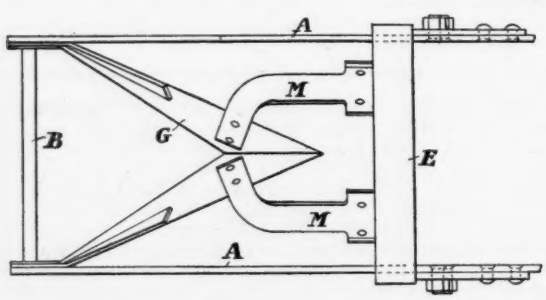
The outsides of the side pieces of the discharging-charger are provided with fixed or butt jointed projections to conform more nearly to the shape of the retort and assure a clean discharge.

The illustrations show the hinged or jointed discharging-charger constructed according to this invention, and an enlarged plan of the plough.

The discharging-charger comprises two parallel side plates A held together by transverse distance-pieces or stays E and hinged together at C in the form of a chain. A stud R working in a curved slot in a hinge-plate T is provided to take the thrust off the centre pins or pivots C when the charger is operated. Suitable pivoted push-plates D are suspended between the side plates from the brackets or arched stays E placed at suitable distances apart in the fire length of the chain.



Fiddes and Aldridge's Retort Discharging-Charger.



The plates are adapted to come against stops F when the charger is entering the retort. They are constructed as light as possible, and are curved to give increased strength "so as to pass lightly over the surface of the coal on the return stroke without withdrawing any coal from the retort."

A reverse plough G, supported rearwards on the front push-plate, is firmly held at one end by stays M attached to the arched stay E and at the other by the stay B to even (on the return movement) the coal that has been deposited on the bed of the retort by the forward movement of the charger. The sides of the front chain link are cut away to allow the plough not only to level the coal between the chain, but to spread it evenly to both sides of the retort.

In operation, the discharging-charger is brought in front of the retort mouthpiece, and a forward movement is imparted to it, while at the same time coal is fed from a hopper or shoot into the spaces between the push-plates. As the charger is moved forward, the coal is pushed along the bed plate and carried by the push-plates into the retort. On the entry of the charger into the retort, the front push-plate imparts a forward movement to the coke in the retort, discharging it from the furthermost end. On the return movement of the charger,

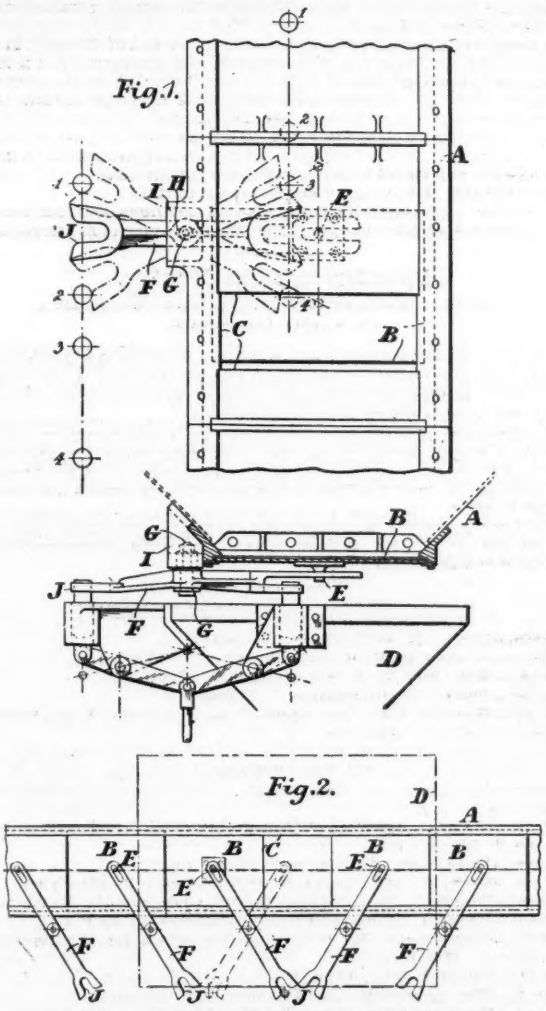
the push-plates take up an inclined position, and are balanced so as to bear only lightly on the surface of the coal—the levelling being finally completed by the reverse plough G, which distributes the coal evenly to both sides of the retort. "By this means it is possible to insert a full charge and distribute it evenly over the whole surface of the retort."

Charging Gas-Retorts, Coke-Ovens, &c.

ALDRIDGE, J. G. W., of Victoria Street, Westminster, and GIBSON, R. E. of Liverpool.

No. 4712; Feb. 26, 1906.

This invention relates to an apparatus in which a charging machine carrying a receiver hopper is traversed underneath a fixed or supply hopper from which the coal is delivered to the machine through the hopper. Hitherto, the patentees say, the charging apparatus has been supplied from a hopper having a single door that is opened by the apparatus as it passes into position under the hopper and is closed by the apparatus as it passes back again to the retorts; or, alternatively, the supply hopper has been provided underneath at the places where it is desired to supply the movable receiver hopper with slide doors that have to be opened and shut by hand, either by a single handle mounted on the traversing apparatus and automatically engaging with shutters and operated by hand to open or shut, or else by separate levers fixed on, or near to, the supply hopper operated by hand. But, according to this invention, the shutters in the fixed or supply hoppers are operated entirely automatically in such manner that, as the charging apparatus is traversed to its different positions, it automatically engages with, and opens and closes, them.



Aldridge and Gibson's Automatic Charging Hopper.

In fig. 1, the supply hopper A is provided with slide-doors B, adapted to close the openings C, through which coal is delivered to the receiving hopper D of the charging apparatus. The openings C are arranged mid-way between the retorts, so that the charge of coal is delivered to the hopper D as the charging machine travels from one retort to the next. On the underside of each door a pin or stud E is fixed, and engages in the slotted or bifurcated end of the operating lever F, which is pivoted on a bolt G inserted in a slot H in a bracket I on the hopper, so that it is adjustable.

The lever is capable of operating the doors, to open and close them while the charging machine is travelling in either direction. For this purpose, it is provided with open-ended slots at opposite ends, which engage with pins or rollers supported on brackets on the chamber D. The inner ends of the levers are each divided horizontally into two branches or arms of unequal length, in which the respective slots are formed. As the charging machine is traversed along the rails in front of the retorts, a pin or roller engages one slot and turns the lever about its pivot until the other end, acting on the pin E, has completely opened the door B. At this point the pin or roller leaves the slot; and when the charger has travelled a predetermined distance (depending on the position of the two rollers), the closing pin or roller commences to act in the slot on the opposite end of the lever.

The numerals 1 to 4 indicate the relative positions of the rollers or pins—1 showing the position when the door is about to be opened, 2 the position when the door is fully open, 3 the position when the door is about to be closed, and 4 the closed position.

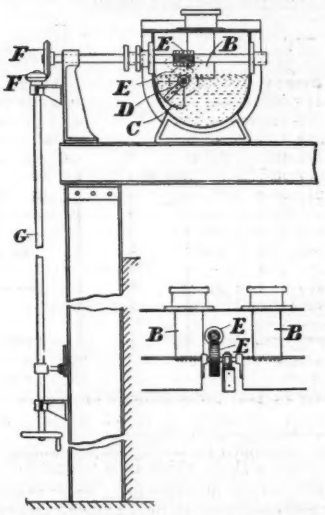
In the modified form shown in fig. 2, the same principle is involved; but instead of opening and closing each door in the supply bunker before passing on to the next, a series of doors or sliding plates B are moved by the charger in succession, so that the opening C is as it were traversed forward along with the charging apparatus and receiver hopper D. As the charging apparatus is traversed backwards, the motion of the doors is reversed, and the opening C is again traversed along with the charger. The levers F are formed with slots J adapted to engage a pin or roller K on the receiver hopper D, the inner ends of the levers having slots only for engagement with the pins E on the doors.

Hydraulic Mains.

EWING, W., of Greenock.

No. 11,125; May 12, 1906.

This invention has for its object to provide mechanically operated means whereby the usual seal may be maintained to prevent the influx of air while the retorts are being charged, and removed to allow free passage of the gas into the hydraulic when the retorts are closed and used for generating gas, "so that the larger production of gas known to be obtainable by the absence of sealing pressure may be secured."



Ewing's Hydraulic Main Sealing Arrangement.

The hydraulic main and pipe connections from the benches of retorts are arranged in the ordinary way; but such a lower level of liquid is maintained in the main that the lower ends of the dip-pipes B do not normally dip into the liquid, and are therefore not sealed. In order to raise the fluid level when required to seal the dip-pipes, a displacer C is fitted within the hydraulic main normally over the liquid level (as indicated by dotted lines) and brought down into the liquid to the position indicated by full lines so as to raise its level and seal the dip-pipes. By preference the displacer is pivoted on a spindle D carried through the hydraulic main and operated by gearing such as the worm gears E and bevel pinions F from a hand-wheel shaft G within easy reach of the retort attendant. When about to recharge the retorts, he operates the gear to bring down the displacer into the liquid and form the requisite seal to prevent the influx of air to the main; and when the retorts are recharged and working again, he operates the gear to raise the displacer and thus remove the seal, so that the gas freely passes into the main.

Rendering Heavy Coal-Tar Oils Odorless.

WIRTH, E., of Dortmund, Germany.

No. 24,344; Oct. 31, 1906.

The so-called anthracene oils or grease oils and those fractions having a higher boiling point possess, as is well known, says the patentee, a characteristic sharp odour which cannot be eliminated by distillation. It is "objectionably noticeable" in sundry applications of the oils, and is probably due to the sulphur compounds which they contain. With other mineral oils, similar sulphur compounds can be removed by treatment with metals or metallic salts; but this process does not effect the desired result in the case of the coal-tar oils. For these substances, a more intense reaction of the metallic salts is necessary—as, for example, is described in the German patent No. 153,585. This process, however, involves considerable cost, and, moreover, the oils suffer internal change due to the energetic treatment.

Experiments have, however, shown the patentee that the highly odorous substances contained in tar oil can be converted by treatment with sulphur under heat into less volatile, odorless combinations—the change taking place at a temperature of from 90° to 100° C. In general, an addition of from ½ to 1 per cent. of sulphur suffices; and the reaction is usually accompanied with the formation of slight quantities of sulphuretted hydrogen.

The treatment of tar oils with sulphur has already been proposed—see, for example, the German patent No. 139,843. In this process

however, large quantities of sulphur are employed at so high a temperature (220° to 250° C.) that the tar oil itself undergoes chemical changes, and is converted into a product which is quite different from the initial substance. But in the present process, the various properties of the raw tar oil are said to be retained without alteration with the exception of the smell; "so that the product can be applied to its various uses equally as well as the raw oil."

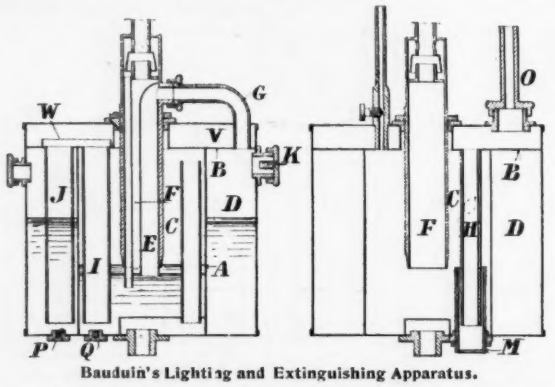
As an example, the patentee says: 10,000 kilogrammes of heavy coal tar oil are heated to about 100° C., and a quantity (varying according to the quality) of from 50 to 100 kilos. of ground sulphur is added thereto. This sulphur is quickly dissolved; the reaction being assisted by stirring (preferably through the medium of an air current) and ceasing in about half-an-hour. Any excess of sulphur is not separated out on cooling, as these oils dissolve when cold as much as 7 per cent. of sulphur. The product, after being cooled, is "ready for immediate use and possesses at the most a weak, soft odour."

Lighting and Extinguishing Gas-Burners.

BAUDUIN, J. G. H., of Maastricht, Holland.

No. 24,432; Nov. 1, 1906. Date claimed under International Convention, March 3, 1906.

In the "JOURNAL" for March 5 (p. 626), an arrangement was fully described and illustrated by which the patentee claimed to be able to light and extinguish gas-burners, with certainty, from a distance; and the present invention is a modification—designed "to enable such apparatus to work satisfactorily even when the quantity of oil constituting the opening and closing liquid [in the operating chamber] varies, owing to changes of temperature, and consequent variation in the percentage of benzol that is dissolved in the oil."



Bauduin's Lighting and Extinguishing Apparatus.

In the example shown, the internal cylindrical wall A (in contradistinction to that described in the earlier specification) extends upwards to the level plate B, to which it is soldered, so that the only communication for the gas between the compartments C and D is through a pipe E arranged within the pipe F and connected to a flexible pipe G, which leads to an opening in the horizontal plate B. The pipe E extends below the lower end of the pipe F for a certain distance—for example, 3 mm.—so that the gas cannot pass through the pipe except when there exists in the compartment C a pressure exceeding by from 5 to 6 mm. the pressure at which the pipe F is opened by the liquid contained in the compartment C. During the whole of the time that the pressure remains below the upper pressure indicated, the compartment D remains under atmospheric pressure, and is in communication with the exterior through a small hole K.

The apparatus is charged through the inlet O with a non-volatile and non-freezing oil (the density of which remains practically constant at the temperatures at which the apparatus is to work); the oil flowing through the pipe H into the compartment C. The apparatus is now connected to a supply of gas at the pressure "r mm." at which the burner is to be lighted. The pressure in the compartment C now causes oil to rise through the pipe I to the level of the plate B, and to flow thence, through the pipe J, into the compartment D. Since this compartment remains open to the atmosphere at K, oil continues to flow into it until it overflows through the side aperture, which is then closed. The oil in the compartment C being now under a pressure of "r mm.," its level is at a distance from the horizontal plate B of "r mm." divided by the specific gravity of the oil, while the tubes H and I are full. The position of the pipe F must now, if necessary, be adjusted so that its lower end is above the level of the oil in the compartment C. For this purpose the flexible pipe G must be disconnected from the pipe F, to which it is again connected after the adjustment of the latter. If the pipe F is in communication with the burner, the latter is lighted.

In order to extinguish the burner, it is necessary to increase the gas pressure to "r + 10 mm.," and to maintain this pressure for about two minutes. When this increase of pressure takes place, the level of the oil in the compartment C falls to a distance below the plate B of "r + 10 mm." divided by the specific gravity of the oil, which consequently flows through the tube H into the chamber V, and through the tubes I and J into the compartment D only. By the lowering of the level of the oil in the compartment C, the lower end of the pipe E is unsealed, and the gas consequently passes through the pipes E and G into the compartment D. The pressure of the gas on the oil in the compartment D now forces oil up the tube J and over the wall W to join the oil that has passed through the tube H to the upper side of the plate B. If the pressure is now suddenly reduced to "r − 5 mm.," the oil above the plate B and outside the wall W is compelled to pass into the compartment C through the pipe H; and the result is that the tube F becomes sealed at its lower end, and the supply of gas to the burner is thus cut off.

In order to relight the burner, the gas is restored to the pressure "r" for about one minute; and as the level of the oil is at a distance below the plate B less than "r mm." divided by the specific gravity of the oil, it is forced from the compartment C, through the tubes I and J, into the compartment D until the lower end of the tube F is again opened by the oil in the compartment C.

When the burner is lighted, only the oil in the tubes H and I can enter the compartment C; and since the cross sectional areas of these tubes are together considerably less than that of the compartment C, the amount of oil in the tubes H and I is not sufficient to seal the tube F, so that the supply of gas to the burner is not interfered with even if the pressure of gas be reduced to as little as "10 mm."

A further object of the invention is to enable one or more of the burners connected to the common source of supply to be extinguished at a different time to the others. For this purpose the oil receptacles of the burners that it is desired to extinguish are each provided with a pipe M (closed at its lower end) extending up through the bottom of the receptacle, so that it can be adjusted in height therein, and the upper end of which is a little above the lower end of the pipe F. The pipe M is arranged concentrically with the pipe H, and surrounding the latter for part of its length. When, now, the pressure of "r + 10 mm." is given for about two minutes, oil collects on the plate B of each of the oil receptacles connected to the common source. If the pressure is now slowly reduced, the oil on the plates B and outside the walls W of those burners that are unprovided with tubes M flows through their pipes H into their compartments C, and at the same time oil is forced from the compartment C through the pipes I and J into the compartments D, in consequence of the communication of the compartment D with the atmosphere through the opening K. The corresponding burners consequently remain lighted. The oil on the plate B and outside the wall W of each receptacle provided with a tube M likewise flows down its pipe H, but is caused by the pipe M to rise above its upper end; and as the upper end of the pipe M is higher than the lower end of the pipe F, and consequently at a less distance below the plate B than "r mm." divided by the specific gravity of the oil, oil remains on the plate B from the moment the pressure commences to decrease until the pressure becomes "r." On a further reduction of pressure, the oil on the plate B flows into the compartment C, and, as the pressure in the compartment C is now insufficient to force oil from it into the compartment D, the oil flowing down the pipe H closes the lower end of the pipe F.

In order to extinguish the remainder of the burners, the pressure of the gas must again be raised and then suddenly lowered, as described.

Incandescence Gas-Mantles.

THORPE, C. P. E., and DOUGAN, O. W., of Wandsworth.

No. 13,181; June 7, 1906.

To increase the toughness and durability of mantles, the patentees propose to treat them with a solution of mercuric chloride ("corrosive sublimate"), which has been found "to give more satisfactory results than any other of the various salts of mercury."

A strong (preferably saturated) solution of corrosive sublimate is prepared by dissolving the latter in water, and the mantles—the ordinary kind at present upon the market—are dipped into the solution, and then supported until dry—by mere exposure to the atmosphere or by artificial heat.

The dried mantles will, it is said, be found "considerably more tough and durable than previous to such treatment, while their luminosity is inappreciably affected."

APPLICATIONS FOR LETTERS PATENT.

5780.—HELPS, G., "Mantles." March 11.
5793.—FARNAM, R. V., "Suction-gas plant." March 11.
5939.—VAN WYE, G. P., "Gas-heaters." March 12.
5960.—BUREL, M., "Gas-stoves." March 12.
6006.—BOWDEN, J. H., ROBINSON, J. A., and JACKS, A. H., "Prepayment meters." March 12.
6023.—MARKS, E. C. R., "Cooling, washing, or enriching of gases." A communication from Act.-Ges. für Kohlendestillation. March 12.
6027.—HINTON, E., and ANDREWS, F. A., "Gas cup-and-ball joints." March 13.
6063.—WILLINGHAM, E. R., "Two-stroke cycle internal combustion engines." March 13.
6115.—HOEK, J. D., "Gas-stove." March 13.
6140.—SYER, M., and TAYLOR, S., "Valve for gas." March 14.
6133.—PRIEST, C. F., and FENN, G., "Gas-producers." March 14.
6164.—PRIEST, C. F., and FENN, G., "Gas-firing of kilns." March 14.
6179.—MACFARLANE, R., "Pilot lighting device for incandescent gas-lamps." March 14.
6183.—KEITH, J. & G., "Making air gas." March 14.
6316.—WELLINGTON, S. N., "Photometers." March 15.
6320.—EWART AND SON, LTD., and EWART, G. H., "Gas-regulating valves for water-heaters." March 15.
6322.—HARDT, J. W., "Gas-light apparatus." March 15.
6323.—FAIRWEATHER, W. C., "Incandescent gas-lamp." A communication from the firm of Julius Hardt. March 15.
6348.—THE BRITISH THOMSON-HOUSTON COMPANY, LTD., "Gas-meters." A communication from General Electric Company. March 15.
6401.—ELLIS, W., "Gas-fittings." March 16.

Douglas Town Council and the Gas Company.—The Douglas Town Council have instructed the Lighting Committee to call upon the Gas Company to guarantee an illuminating power of 16 candles, and to comply with prescribed tests, failing which to have an Arbitrator appointed. A Special Committee have also been instructed to have new legislation introduced, bringing the duties and services of the Company into line with modern requirements as regards power and purity, the supply to private consumers, reasonable limits as to profits and dividends, and charges for cooking, heating, and power.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by our Correspondents.*]

"Coalite."

SIR,—Is there any novelty in this fancy-named substance? I remember, in the discussion on Sir Charles Cookson's paper at the Smoke Abatement Society's conference last summer, that one of the speakers described what appeared to be a process identical with that for the production of "Coalite." But to stop the process of gasification is surely absurd in these days of the Welsbach burner. We want more gas of lower illuminating value, rather than less gas of a higher value. The tendency is to lower the candle power; and rightly so.

ECONOMY.

March 21, 1907.

Increased Storage or Additional Retorts.

A correspondent would be glad to have an expression of opinion on the above question, which has arisen under circumstances which he sets forth as follows: At present we have two gasholders—one holding 18,500 and the other 14,400 cubic feet, making a total (say) of 33,000 cubic feet. Our greatest day's make is 55,000 cubic feet. It is generally understood that the gasholder capacity should equal the greatest day's make in the year; therefore we are 22,000 cubic feet short of proper storage room. Our difficulty is this: For a time on each side of Christmas, with both holders full at 4 p.m., by 8 p.m. one would be down, and by 11.30 p.m. the other also, within a foot or two, which is dangerously near being out of gas altogether. I have told my Directors that there are only two ways of meeting the matter—one to put up an additional holder, and the other to increase the number of retorts (*i.e.*, by another bed). I said the proper way was to increase the holder room, as being the most economical—that providing more retorts to meet an intermittent demand was both a wrong and a wasteful principle. Am I right or wrong?

Liability for Non-Supply of Gas.

A correspondent writes: At our last meeting of Directors, the above question was discussed; and, in view of the unsettled state of the coal question as to prices, and the possibility of a strike, it was considered by some that gas companies were in a very serious position in the event of a strike, as, according to the Gas-Works Clauses Act, 1871, there is no exemption from penalties should the gas supply fail from any cause whatever. In 1892, we obtained a Provisional Order, in which, I believe, we are exempt from any penalty, if it is proved that the failure results from unavoidable cause or accident. As clause 37 says: "No penalty shall be incurred by the undertakers for insufficiency of pressure, defect of illuminating power, or excess of impurity in the gas supplied by them in any case in which it is proved that such insufficiency, defect, or excess was produced by an unavoidable cause or accident." I shall be glad to be informed of an instance in which a gas company have been convicted, in case of failure of supply in consequence of a strike. It appears to me to be a great injustice to gas companies who have not a similar clause to ours—and I believe there are many—as by the 1871 Act there is no doubt as to a company being liable for failure of supply. Are the electric light companies under a similar penalty?

The Experiments with Inclined Retorts at Guildford.—A correspondent who (as a Director of a Provincial Gas Company) has watched for a considerable period the various new processes introduced in connection with the manufacture of gas, writes on the above subject as follows: "I have never seen or read of a scheme for the improvement of the manufacture of gas which seemed to me to promise such important results. Unless unforeseen difficulties should be met with in carrying this method into practical use, I venture to think it will revolutionize the system of manufacture. Keeping the newly extracted gas in contact with the coal in its passage through the retort is, to my mind, a novel and important feature."

The Purchase of the Pontefract Gas-Works.

A circular to the shareholders of the Pontefract Gas Company has been issued by Mr. R. D. Ryder, the Secretary, in which he states that the Directors propose to divide the £69,600 awarded by the Umpire (Sir Hugh Owen) as the price to be paid by the Pontefract Corporation for the purchase of the undertaking of the Company (*ante*, p. 703), at the rate of £25 for each original (£10) 10 per cent. share, and £17 10s. for every new (£10) 7 per cent. share. This will leave a balance of £1600, out of which the Company will have to pay such costs of the arbitration as may not be allowed on taxation; the balance, of course, being further divisible among the shareholders. The Corporation have to pay off the mortgage debt (£5000), the taxed costs of the arbitration, and the winding-up expenses of the Company, as well as the maximum dividends up to July 1 next. The 10 per cent. shares, when last sold by auction, realized £25, and the 7 per cent. £16 2s. 6d., though it is reported that the former have since changed hands privately at as high as £27 10s.

Llandudno Gas Managership.—At the last meeting of the Llandudno Urban District Council, Mr. M'Master reported that 130 applications had been received for the position of Gas Manager; and a tabulated list would be supplied to every member. Mr. Sarson complained that the works had now been left for three months without responsible management, and that the Gas Committee were dilatory in recommending a successor. Mr. M'Master, however, protested against these aspersions, and assured the Council that they would be very agreeably surprised when they received the figures for the three months which had elapsed since the late Gas Manager's resignation, and since Mr. Morton and others had had control of the works.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills read a second time: Sheffield Corporation Bill, Aberdeen Corporation Bill.
Bill reported, with amendments: Devonport Corporation Bill.
Bill read the third time and passed: Newquay and District Water Bill.

The Birkenhead Corporation Water Bill has been referred to a Select Committee, consisting of Lord Newton (Chairman), Viscount Hampden, Lord Teynham, Lord Ravensworth, and Lord Weardale; to meet on Tuesday, the 23rd prox.

The Portishead District Water Bill, Selsey Water and Gas Bill, Southend Water Bill, Tees Valley Water (Consolidation) Bill, and Tynemouth Corporation (Water) Bill have been referred to a Select Committee, consisting of the Earl of Lauderdale (Chairman), the Earl of Scarborough, the Earl of Carnwath, the Earl of Verulam, and Viscount Colville of Culross, to meet on the above-named day.

The Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water-Works Bill, Broadstairs and St. Peter's Urban District Water Bill, Colne Valley Water Bill, Coventry Corporation Water Bill, Great Yarmouth Water-Works and Lowestoft Water and Gas Bill, Pontypridd Urban District Council Bill, Southport, Birkdale, and West Lancashire Water Board Bill have been referred to a Select Committee, consisting of Lord Ribblesdale (Chairman), the Duke of Wellington, Lord Zouche of Haryngworth, Lord Seaton, and Lord Ritchie; to meet on the above-named day.

The Glasgow Corporation Bill and the Renfrewshire Upper District (Eastwood and Mearns) Water Bill have been referred to a Select Committee, consisting of the Earl of Camperdown (Chairman), the Marquis of Bath, the Earl of Hardwicke, Lord Faber, and Lord Haversham; to meet on Tuesday, the 30th prox.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bill read the first time and referred to the Examiners: Newquay and District Water Bill [Lords].
Bill read a second time and committed: Boston Spa Gas Bill.
Bills reported, with amendments: Brockenhurst Gas Bill, Maidstone Gas Bill, Mitcham and Wimbledon District Gas Bill.
Bills read the third time and passed: Gas Companies' (Removal of Sulphur Restrictions) Bill, Llandrindod Wells Gas Bill.

The Metropolitan Water Board (Charges, &c.) Bill and Metropolitan Water Board (Various Powers) Bill are to be considered by a Joint Committee of the two Houses.

UNOPPOSED GAS BILLS.

On Friday, the Unopposed Committee of the House of Commons had under consideration three Gas Bills. Mr. ALFRED EMMOTT (Chairman of Ways and Means) presided; and the other members present were Mr. J. CALDWELL (Deputy-Chairman), Mr. J. W. HILLS, and Mr. J. J. MOONEY.

Brockenhurst Gas Bill.

By this Bill powers are sought for the incorporation of the Brockenhurst Gas Company with a capital of £15,000, to acquire land, and to construct works in the parish of Brockenhurst, Southampton.

Mr. BAKER (Parliamentary Agent for the Bill) said that Brockenhurst was a residential district; and the Company sought powers to supply gas there. In addition to the £15,000 capital, they asked for the usual one-third borrowing power. The maximum price was 5s. per 1000 cubic feet.

The CHAIRMAN: Why do you want 5s.? You are close to the coast; and it cannot be expensive to get coal there.

Mr. BAKER: It is some distance away.

The CHAIRMAN: But how far?

Mr. BAKER: It is not far from Southampton; but there is the freightage from there.

Mr. CALDWELL asked what was the price of gas in adjoining parishes.

Mr. *E. H. Stevenson* (who was called to prove the preamble) replied that in small places of this description the price of gas generally started at about 4s. or 4s. 6d. per 1000 cubic feet.

The CHAIRMAN inquired whether there was a sliding-scale.

Mr. BAKER replied that it was not usual in a new company to have a sliding-scale.

Mr. *Stevenson* stated that the proposal had been before the Local Authorities; and the Bill had received their assent.

The CHAIRMAN: There are no reports from Government Departments, are there?

Mr. BAKER: No.

The Bill was ordered to be reported.

Maidstone Gas Bill.

[Mr. CALDWELL took the chair, as Mr. Emmott was called away at this point.]

The proposal of the Maidstone Gas Bill is to extend their limits of supply to Harrietsham, Lenham, Bromfield, Chart-next-Sutton Valence, East Sutton, Sutton Valence, Ulcomb, Boughton, Malherbe, and Hunton; to relieve the Company of restrictions imposed upon them in respect of sulphur compounds (except sulphuretted hydrogen); to lay down, make, and maintain a tramroad for the purpose of transporting coal, coke, and other products and materials to

and from the works of the Company and the South-Eastern and Chatham Railway; and to take power to charge 6d. per 1000 cubic feet more outside Maidstone than inside the borough.

Mr. ANDERSON (the Agent) explained the purposes of the Bill; and said that, with regard to the removal of the sulphur restrictions, they had adopted the clause from the Act passed last year. Dealing with the question of the price of gas, he said they had three zones of charges. Under their existing Acts, the standard price for the borough of Maidstone for a radius of 1½ miles was 3s. 7d. per 1000 feet; between that zone and 4 miles, it was 4s. 4d.; and they were now asking to charge an additional 6d. in the places to which they were taking gas. The figures he had mentioned were maximum charges. They were actually charging for Maidstone and 1½ miles 2s. 4d.; the next zone had to pay 3s. 1d.; and the outside places would have to pay 3s. 7d. These outside parts wanted the Company to come in; and those which were actually supplied with gas at the present time were paying 4s. 9d. per 1000 feet.

The CHAIRMAN: What is your dividend at present?

Mr. ANDERSON replied that they paid £7 12s. 6d.

The CHAIRMAN: Have you any money invested for renewals?

Mr. ANDERSON: We have a reserve fund of £5000. The Bill was opposed by the Maidstone Corporation; and we have settled with them. They did not object to our having a renewal fund clause in the Bill.

The CHAIRMAN: Have you a sliding-scale?

Mr. ANDERSON: Yes. Though I used the word "maximum," it is a sliding-scale company, and not a maximum price company. We also had opposition from the Sutton Valence Gas Company; but we settled that by buying them out.

Mr. MOONEY: Are you reducing your illuminating power?

Mr. ANDERSON: No. We are taking the new form of test, that is all. This is the Model Bill clause.

Mr. HOAR (Solicitor to the Company) having proved the preamble, the Bill was ordered to be reported.

Grays Gas Bill.

The objects of this Bill are to re-incorporate the Grays Gas Company, to extend their area of supply, and to increase the capital from £64,000 to £150,000, and allow one-third of the latter figure as borrowing powers.

Mr. BAXTER (the Agent) said that the Bill was opposed by the two Local Authorities, who went carefully into the matter, and amendments had been made which had satisfied them.

The CHAIRMAN: What is your present charge?

Mr. BAXTER: Under our Order of 1881, the Company have the power to charge 6s. per 1000 cubic feet within a radius of a mile of the gas-works, and 6s. 6d. beyond. That is the maximum, of course. What we have been charging is 4s. We have the sliding-scale applied to us; and we seek to make the standard price 4s. 4d. in the inner circle, and 6d. extra outside. But within the inner circle we put the whole of the district of Grays, to meet the opposition of the Local Authority.

The CHAIRMAN: How do you work your sliding-scale?

Mr. BAXTER: We have made an amendment to give effect to the requirement of the Local Government Board; and the clause now follows the section of the Crediton Gas Act, 1906, to which the Board refers.

Mr. HILLS: What are you paying in dividends?

Mr. BAXTER: On our "A" shares the maximum is 10 per cent., and on our "B" shares 7 per cent. Last year we paid 8 per cent. upon the 10 per cent. shares, and £5 12s. upon the 7 per cent. shares.

The CHAIRMAN: You have a renewal fund in clause 42, which is new. It is ½ per cent.

Mr. BAXTER: Clause 42 provides for a half-yearly payment—½ per cent. in any half year. That makes 1 per cent. in the year.

The CHAIRMAN: It has to come up to 10 per cent. on the paid-up capital?

Mr. BAXTER: Yes.

The CHAIRMAN: What is your present capital?

Mr. BAXTER: The authorized capital is: Under our first Order, £10,000; under the second Order, £30,000; and our third Order brought it to £88,000. Of that we have raised £64,000, so that we have some authorized capital not raised which will be extinguished by the present incorporation and will be included in the total capital asked for—viz., £150,000.

The CHAIRMAN: You want to bring the £64,000 up to £150,000?

Mr. BAXTER: Yes; and I think we convinced the Local Authority that this was a reasonable sum.

The CHAIRMAN: What is the additional capital required for?

Mr. *F. E. Bartlett* (Chairman of the Company) replied that they were applying for power to supply gas in five extra parishes; and it would nearly double their area of supply. In addition to this, the whole of their present district was growing very rapidly.

The CHAIRMAN said there were a good many new points in the Bill, the sliding-scale, renewal fund, and so on; and he thought it had better be left over till the next Committee meeting, so that the matters could be gone into very carefully.

The preamble of the Bill was, however, proved, subject to the clauses being found to be of a satisfactory nature.

Moscow in Darkness.—Following closely upon the recent strike of electric light workers in Paris, came one of gas workers in Moscow on Monday last week. Their action was ostensibly in support of the tramway hands; the water and electricity supplies were menaced for the same reason. All the municipal troubles were due to the refusal of the Town Council to dismiss their Engineer. As the result of the strike, the city was given over to disorder. Bands of hooligans paraded the streets, which presented a deserted appearance. Cabs disappeared from the ranks, and the police abandoned their usual posts and collected in groups, or sought cover under convenient arches. The few oil-lamps that emitted a feeble light were quickly smashed; and the boulevards were left in total darkness save for the light afforded by the stars.

MITCHAM AND WIMBLEDON DISTRICT GAS BILL.

House of Commons Committee.—Tuesday, March 19.

(*Before Sir* FREDERICK BANBURY, *Chairman, Mr.* FIENNES, *Mr.* RAPHAEL, *and Mr.* MOND)

The consideration of the clauses of this Bill was proceeded with to-day.

Mr. YOUNG (Parliamentary Agent for the Wandsworth Borough Council) thought some alteration should be made in clause 29*a*, which says: "Section 7 ('Testing Gas') of the Order of 1892 is hereby repealed." He pointed out that the promoters had only to construct the new testing-place within twelve months; and if by the new Act section 7 were at once repealed, there would be no testing-place for twelve months. He thought that the new clause should stipulate that the section referred to should be repealed as from the date on which the new testing-place came into use.

Mr. COOPER (for the promoters) said he was a little doubtful whether it was quite parliamentary to legislate that a certain thing should be done as from the date of something being erected. He thought there must be a specific date.

Mr. LEES (for the Wimbledon Corporation and the Croydon Rural District Council): There is a specific date. Within one year from the passing of the Act you have to put up the new building.

Mr. RAPHAEL suggested that the clause should read: "The Order of 1892 is hereby repealed from the date at which the provisions of this clause come into effect."

Mr. YOUNG: That will do. You cannot put a definite date.

Mr. LEES: You could put at the end of the clause "as from the time when this testing-place has been provided."

Mr. COOPER: Or the clause might read "As from the expiration of the said period, section 7 ('Testing Gas') of the Order of 1892 is hereby repealed."

After some discussion, the clause was made to read that section 7 was "repealed as from the date when the new testing-place and apparatus hereinafter provided for shall come into use."

Mr. YOUNG said there was a slight objection with regard to the addition to clause 34, as drawn. Mr. Balfour Browne, in his address, expressly said, and it was agreed to, that the mains were to be laid, under the superintendence of the Local Authority, at a depth not less than 2 feet below the surface. They had drawn it in this way: "Provided that, before laying or relaying such pipes, the Company shall give three previous days' notice thereof to the Local Authority concerned, who shall within 48 hours thereafter notify to the Company the reasonable depth, being not more than 2 feet." He said it should read not less than 2 feet." He was quite willing to add the words, "not "less than 2 feet nor more than 2 ft. 6 in." The object was this: In new streets the roads were very uneven; they were builders' roads, and it was often necessary to pare off 6 inches of the surface. If the pipes were laid not more than 2 feet down, it would bring them within 18 inches of the surface.

Mr. LEES: I support Mr. Young. Mr. Balfour Browne said "not less than 2 feet." The clause as drawn is a totally different thing. We only want to see that it is all right; and we ask them to stick to what Mr. Browne said.

Mr. YOUNG: Local authorities are being held liable now for damage to gas-mains by the use of steam-rollers, which must go over the road; and if the pipes are so near the surface ——

Mr. COOPER (interrupting): The original proposition was, in Mr. Fitzgerald's own notes, "Not more than 2 feet below the surface." That is the sole condition upon which, in consultation, we agreed to the clause at all. As the whole object of our proviso was that we should not render ourselves liable to have to lay mains at any depth they called upon us to put them at, it was necessary for us to prescribe a maximum depth of 2 feet. During the handling by Counsel, the clause got altered. Here is Mr. Fitzgerald's own copy. The words handed to him were "not more than," and he himself altered them at Mr. Vesey Knox's suggestion, and changed the word "more" to "less." In my copy it is "not more than." When Mr. Balfour Browne read it as altered by Mr. Fitzgerald, he (possibly not seeing the importance of it at the time) read "not less than." It would be very hard on the Company to hold them to that.

Mr. LEES: If you stick absolutely to the minutes of proceedings, you have "not less than." This would suit us. We are quite willing to meet Mr. Cooper. We do not want to be unreasonable. I quite agree with Mr. Young that if you put in "not less than 2 feet nor more than 2 ft. 6 in.," the promoters are absolutely protected, and we may have 6 inches to pare off. I think that is a fair suggestion on the part of the Local Authorities.

The CHAIRMAN: We are bound to take the minutes as they appear here, and especially as my recollection and that of the Committee is that the word was "less," and not "more." I think we must have "less;" but I can see that there is an objection to it. Therefore I propose to put in "not less than 2 feet nor more than 2 ft. 6 in. below."

The clauses of the Bill were then further proceeded with. When the schedule was reached,

Mr. RAPHAEL remarked that there ought to be something in the Bill to protect Mr. Pitt, the owner of the houses in the neighbourhood of the projected new gas-works.

The CHAIRMAN pointed out that the promoters had made the suggestion that a manufactory should not be put within 40 feet of the road. This, however, was not to be held to bind them not to build storage works, clerk's offices, or anything of the sort.

Mr. COOPER: We are quite prepared to give that undertaking, if it is asked for.

The COMMITTEE CLERK: What is the remedy if the undertaking is ignored?

Mr. LEES: There is no remedy with regard to a statutory company, unless it is in the Act of Parliament.

The CHAIRMAN: It ought to be in the Act. It is not a very difficult thing to draw, is it?

Mr. COOPER: It is not a difficult thing to draw, but it may be a

serious thing for the Company, because so long as it is merely an undertaking—so long as it is an undertaking given solely for the benefit of this particular petitioner—it can be altered by agreement between the two parties. But if you put it in the Act, it absolutely debars one from manufacturing for all time—long after this estate may be in other hands, or after it may have tumbled down.

Mr. RAPHAEL: If you put in "with the consent of the owner for the time being," that gets over the difficulty.

Mr. COOPER: Certainly. I did not understand that the Committee intended that there should be a statutory restriction on the use of the land.

The CHAIRMAN: It was your own proposal. What is the use of your saying in this room that you are prepared not to build manufacturing premises within a certain distance of Mr. Pitt's frontage if within two years' time you do it? There would then be no evidence that you had given the undertaking in this room, and Mr. Pitt's only remedy would be that it was a nuisance, and that you were damaging his property. You must draw a clause; but I think there is something in the point that you do not want to say that you shall never be at liberty to build there.

Mr. COOPER: If you refer to clause 4, you will see that we have a clause which sought to enable us to get out of the very difficulty you are seeking to put us in now with reference to the new site. There we endeavoured to relieve ourselves of the restriction put upon us by the Provisional Order of the Board of Trade in 1892. We were trying to get out of it by this Act.

The CHAIRMAN: I will adjourn this particular clause until to-morrow, so that you may see what Mr. Balfour Browne says.

Mr. COOPER: Would you be content if a clause were inserted giving protection to this particular petitioner—not a statutory restriction for all time?

The CHAIRMAN: We shall be contented with that. We have given our decision, and it really does not much matter what the petitioner says. He has to abide by it.

Mr. COOPER next pointed out that there was another matter which arose out of the clause inserted at the instance of the London County Council. In the terms as read out to the Chairman it ran: "Clause 5 (as to testing for calorific power, sulphur impurities, and illuminating power with flat-flame and incandescent burners) of the South Suburban Gas Act, 1906, to be inserted in the Bill, omitting (2) and (4) of the section." Mr. Cooper said that when they were at the consultation they did not realize what were portions of the Act specified. They had since considered the matter, and he understood that the London County Council would not object if sub-section 4 of the South Suburban Act were incorporated. He should like to have time to further consider this matter.

The CHAIRMAN said it would be dealt with, in conjunction with other matters, next day.

Wednesday, March 20.

On the re-assembling of the Committee this morning, the consideration of clause 29*a* was first taken.

Mr. COOPER proposed to add the words: "Section 7 ('Testing of Gas') of the Order of 1892 is hereby repealed as from the date when the new testing place and apparatus hereinbefore provided for shall come into use."

This was agreed to.

Mr. COOPER said he had consulted his clients in reference to the insertion of sub-section 4 of the South Suburban Gas Act of last session, and they had instructed him to put it in the Bill. As the London County Council had not raised any objection, he proposed to do this.

The CHAIRMAN agreed.

Mr. COOPER said the new clause was inserted as sub-clause 3: "The illuminating power as ascertained by means of a burner fitted with an incandescent mantle, such burner and mantle being of the best available pattern, and to be so used as to obtain from the gas the greatest amount of light." With regard to the other matter standing over, he had communication with Mr. Pitt's Solicitor, and they had agreed to the following clause: "Provided that the Company shall not construct any works for the manufacture of gas within a distance of 40 feet from the west side of Century Road, in the parish of Mitcham, without the consent in writing of George Pitt, the owner or reputed owner of the houses situate on the east side of Century Road aforesaid, or his heirs or assigns."

The CHAIRMAN having agreed to the insertion of this clause, the preamble of the Bill was read and agreed to; and the Bill, as amended, was ordered to be reported.

Salford and the Retailing of Coal and Coke.—A resolution has been carried in the Salford Town Council instructing the Gas Committee to consider the advisability or otherwise of retailing coal and coke, or either of them, direct to the residents of the borough.

Gas Tragedy at Reading.—Some days ago, a bailiff and his assistant, on entering a house at Reading through a window, found the occupants—a Mrs. Holdway and her son, for the apprehension of both of whom warrants had been issued—dead in a bedroom. Fixed to a gas-jet was a rubber tube from which gas had apparently been inhaled first by the mother and then by the son, as the pipe was hanging over the man's shoulder as if it had dropped from his mouth.

Increase in Price at Brentwood.—In moving the adoption of the report at the annual meeting of the Brentwood Gas Company, the Chairman (Mr. S. Ray) said the Directors felt that they were studying the interests of the Company by carrying forward a further amount of £234, rather than by giving an extra 1 per cent. dividend, which required £350. The ordinary consumers had increased from 752 to 850, and the prepaid meter consumers from 168 to 311; while 52 new cookers had been fixed, making the number in use 331. The Company's coal contract was expiring; and they had not had one offer less than 2s. 6d. per ton advance. They regretted to have to increase the price of gas by 2d. per 1000 cubic feet, bringing it to the price it stood at before the reduction last year—namely, 3s. 9d. The report was adopted; and a dividend of 8 per cent. was declared.

WORTHING GAS BILL.

House of Commons Committee.—Tuesday, March 19.

(*Before Mr.* A. HUTTON, *Chairman, Mr.* R. HUNT, *Mr.* AGNEW, *and Mr.* J. JOHNSON).

This was a Bill to authorize the Worthing Gas Company to acquire lands for manufacturing and storage purposes, to extend the limits of supply, and to consolidate and convert existing, and raise further, capital.

Mr. HONORATUS LLOYD, K.C., Mr. TALBOT, K.C., and Mr. BERNARD WILKINSON appeared for the promoters. The petitioners in opposition were Lieutenant-Colonel W. G. Margesson and others, who were represented by Mr. RAM, K.C., and the East Preston Rural District Council, who were represented by the Hon. J. D. FITZGERALD, K.C., and Mr. A. F. BART.

Mr. HONORATUS LLOYD, in opening, said the objects of the Bill were—(1) To authorize the Company to acquire by agreement certain lands, and to sanction the use of these lands for the manufacture and storage of gas; (2) to extend the limits of supply; (3) to authorize the consolidation and conversion of existing capital; and (4), to authorize the raising of additional capital. The Company was formed in 1835, and became a statutory concern in 1868, when the capital was fixed at £25,000; £12,250 of this being stock bearing a 10 per cent. maximum dividend and £12,750 share capital bearing a 7 per cent. maximum dividend. In addition to this, they were authorized to borrow £8000. In 1875, the Company extended their limits, and increased their share capital by £25,000, and their borrowing powers by £6250. The maximum price at that time was 6s. 6d. per 1000 cubic feet. In 1894, the Company being unable to obtain any land adjoining the existing site to extend their works, they found another site at Ham Field. Here they took a course which proved to be very unwise; for, in order to conceal the fact that the Company were the intending purchasers, they bought the land without making any trial borings whatever to determine the suitability of the subsoil. They subsequently obtained power to raise £32,000 of additional capital, and were granted £8000 further borrowing powers; and for the first time they were turned into a sliding-scale Company, with a standard price of 4s. 3d. per 1000 cubic feet and a neutral zone from 4s. 3d. to 3s. 9d. These prices were to be reduced by 3d. on the abolition of the local coal-dues. They were subsequently abolished; so that the standard price was now 4s., and the actual price charged at present was 3s. 6d. On setting to work on the Ham Field site when the gas consumption had greatly increased in 1895, the Company found that the subsoil was sand and running water, and that, in order to use it for their purposes, they would have had to go to a most unreasonable expenditure in piling, &c. They therefore at a later time sold the site (which had cost £2350) at a loss of £1050. In 1904, they increased their authorized capital by £32,000, and their borrowing powers by £10,060. Since then an immense increase had taken place in the demand for gas; and the Company found a fresh site in the parish of Goring, outside the borough boundaries. They had entered into an agreement with the owners to purchase the land (the area of which was 18 acres) provisionally upon the Bill passing. They wished to erect a holder on the site at once. As to extension of their limits of supply, they desired to include the parishes of Goring and Durrington, which would be conveniently served from the proposed holder. Regarding the third object of the Bill, the Company proposed to convert their 10 per cent. stock and 7 per cent. shares into 5 per cent. shares, by allotting £200 of 5 per cent. capital to every holder of £100 of 10 per cent. stock, and £14 of 5 per cent. capital to every holder of £10 of 7 per cent. shares. To this alteration, and to the fourth main proposal of the Bill, there was no opposition. They asked for power to raise £100,000 of additional share capital, with the usual one-third borrowing powers. Their total authorized capital at present was £114,000, and their total borrowing powers £32,916. There was £38,470 share capital and loan unissued, which by the Bill they proposed to repeal, excepting in respect of £7000 to enable the Company to go on with their development till the conversion took place.

Mr. *H. H. Gardner*, the Chairman of the Company, was examined in detail. In respect of the new gasholder proposed to be built on the Goring site, he said they intended to connect it with their works in the town of Worthing by a high-pressure main.

Mr. *W. A. Walker*, the Engineer and Manager of the Company, stated that the maximum daily output was 700,000 cubic feet; but the storage capacity was only 520,000 feet. A new holder was, therefore, imperatively necessary.

Mr. *C. L. Morgan*, the Chief Engineer of the London, Brighton, and South Coast Railway, gave evidence to the effect that the proposed site was an excellent one.

Mr. *Charles Hunt* said the proposed site, which he had carefully examined, was a piece of agricultural land surrounded by agricultural land. Four holes had been dug there; and he formed the opinion that the site was thoroughly suitable for the construction of gas-works. Water was met with on an average 16 feet from the surface. This was a very favourable fact. Many parts of a gas-works had to be laid underground. It was not necessary to lay these portions wholly underground; but all the mains had to be underground, and it was necessary that they should rest in dry soil. Regenerative furnaces were laid underground, so that the retorts might be worked from level ground. He had had experience of attempting to construct gas-works in water-logged ground. At Birmingham, when constructing two large tanks, running sand and water were encountered, with the result that all operations had to be suspended for twelve months to enable the contractor to provide additional pumping arrangements; the result being that the cost of the two tanks exceeded the estimate by 30 per cent. The construction of a small gas-works in Ireland on water-logged ground necessitated the raising of the whole surface of the ground by 7 or 8 feet; the addition to the cost of the works being fully 20 per cent. Therefore, if it was possible to obtain a site free from water, there was no sense in using one that was water-logged. The result of laying mains in water-logged soil would be that one could not alter or extend them without draining a very considerable area, which would be almost

impracticable, besides which there would be great difficulty in keeping them free from water. There was always the risk of leakage; and if water got into the pipes, it would stop the operation of the works. He had seen a section of the borings of the Ham Field site, which showed that water was met with there at an average depth of 18 inches from the surface. If this were correct, it would not be rational to place gas-works in such an area, if another site could be obtained.

In cross-examination by Mr. FITZGERALD, witness admitted that in works of moderate size, like these Worthing works, the furnaces were frequently above ground. But this added to the cost; they had to make the building higher. The choice of sites was limited, because they had to keep near a railway, otherwise the cartage of coal between railway and works cost 8d. a ton. This represented less than 1d. per 1000 cubic feet on the price of gas; but one would not deliberately select a new site away from the railway. He was aware that the Birmingham Corporation proposed two or three years ago to go outside their own borough, and set up works in an adjoining district. It was also true that they were already supplying gas in the district, and the Local Board of the district objected to it. Parliament refused to sanction the proposal; but they did not give as their reason that Birmingham must keep its nuisance to itself.

In re-examination by Mr. HONORATUS LLOYD, as to the Birmingham precedent, witness said the district to which Birmingham proposed to go was the urban district of Erdington, a populous district with 18,000 or 19,000 people; so that it did not compare in any way with the site which had been chosen here. He had never in his experience seen a site which was freer from inhabitants than this one. As to the question of a railway, certainly nobody in modern days would recommend the setting up of a gas-works away from a railway, if there was a site available adjoining a railway.

Sir *George Livesey* said he had seen many sites for gas-works, but none more unobjectionable than that which the Company had chosen. The Ham Field site, on the other hand, would be the very last one that he would choose. He had seen the house of Mr. Schweder, who opposed the Bill, and he did not think the proposed gasholder would be the slightest inconvenience to this gentleman. Gas-works had a bad name. This was due, he thought, to lime purification. Parliament had recently, however, relaxed the obligation to use lime.

In cross-examination by Mr. FITZGERALD, with a view of establishing that a water-logged foundation was not an insuperable objection, witness admitted that at East Greenwich, where all the extensions of his Company were going on, there was a bed of peat, and at a depth of about 15 feet they came to ballast.

Mr. *Duke*, a well-borer, being called to give evidence about the nature of the subsoil at Ham Field,

The CHAIRMAN suggested that there had been enough evidence on this point.

Wednesday, March 20.

Mr. *Joseph Cash*, referring to high-pressure mains, which is the form of main proposed to be used for conveying the gas between the present works and the new gasholder, said he had had special experience with regard to these high-pressure mains. He would put turbines with fans on to the existing works, and drive the gas through the main at a considerable pressure. He thought that through a 6-inch steel pipe 22,000 to 25,000 cubic feet of gas per hour could easily be transmitted. As to cost, his view was that the high-pressure main and the distributing main would cost £4500; and adding to this the cost of the machinery to produce the pressure, £500, the total cost under this head would then be £5000.

In cross-examination by Mr. FITZGERALD, witness was asked if he remembered the time when the east end of Brighton was a good residential part of the town, to which he assented. Counsel then asked him if gas-works were authorized just beyond this fashionable quarter, and if from that time onward there was no extension beyond the gas-works. Witness replied that there was no extension beyond on the way to Rottingdean.

Mr. FITZGERALD: From that time Brighton never extended in that direction?

Witness: There was no need for extension at that point.

You have merely a gasholder station there now?—But perhaps you will allow me to remark that at Hove, which is on the extreme boundary of Brighton, we had, up to a recent period, our works there. Why did they extend so much to the west when there was a gas-works there?

But since you have removed your works from there to Shoreham Harbour, the increase in Hove has been almost phenomenal, has it not?—There has been a very large increase.

Mr. TALBOT re-examined witness in reference to the gas-works at Shoreham Harbour, and he stated that a great deal of building had taken place around the gas-works; so that his experience entirely negatived the view that the presence of gas-works prevented building development.

Mr. *William Cash* was called to rebut certain aspersions cast locally upon the liquidation and assets of the Company, which he said were groundless.

This closed the case for the promoters.

Mr. *Fitzroy Somerset*, of Castle Goring, was the first witness called by Mr. FITZGERALD in opposition. He said some of his property was in the parish of Goring, where the new gasholder was proposed to be placed. His own residence was a mile-and-a-half from the proposed site. His personal objection to the proposed gasholder was that it would cut his line of view to the sea; his other objection was that it would spoil a model rural parish. Both the Parish Council and the District Council opposed the Bill.

In cross-examination, witness admitted that the Rural District Council, though opposing, would not risk their own money on the opposition, and the expense, in fact, was borne by the landowners of Goring, including a Mr. Schweder, who had been very active, as he lived nearest the proposed site.

The Rev. *G. Leefe*, Vicar of the parish of Goring, and Chairman of the Parish Council, said he thought few of the inhabitants would require the gas; most of them being cottagers. The people were, generally speaking, opposed to having gas-works there.

In cross-examination, witness admitted that there was little building development going on in the parish. He had known 14 houses to be erected in six years.

Dr. *J. E. Molson*, the tenant of Goring Hall, said he thought if the gas-works were set down in Goring they would be detrimental to it as a nice rural village. If they were built, he should determine his lease of Goring Hall. Opinion in the village was decidedly against the scheme.

Mr. *W. F. H. Lyon*, the owner of 1200 acres in the parish of Goring, expressed the opinion that the presence of gas-works would entirely alter its character. He considered that within a radius of 500 yards of the gas-works the land would be depreciated 50 per cent. in value; and beyond that, to the extent of half-a-mile radius, it would be depreciated 25 per cent. If West Worthing extended on to his property, the value of the land would go up; if the gas-works stopped that extension, it would go down.

Mr. *C. B. Cook*, an estate agent and surveyor, of Worthing, said that Worthing was developing on the west—the side abutting on Goring. The new property was of a good class, rents ranging from £70 to £150. The erection of the gasholder would seriously hinder the development of the building land. He thought there would be no difficulty in getting a site for gas-works at the east, or north-east end of the town. At the east end there was already the refuse destructor, the sewage tanks, and the slaughter-houses; and that seemed to be the proper place to put down another "nuisance," if they had one.

Mr. *E. H. Stevenson*, while agreeing that the new gasholder was required, said the manufacturing plant was equal to considerably more than the present demand. He understood that the promoters proposed to use this new site for the new holder, and to retain the manufacturing works for a period which they had not stated on the present site in Worthing; the two being connected by a main. Personally, he would have advised the Company to contract for a larger gasholder than was mentioned by Mr. Cash, who put it at 500,000 cubic feet. Mr. Cash suggested that a 6-inch steel main should be laid down to supply 500,000 cubic feet a day at considerable pressure; but a steel main would be absolutely useless when the works were shifted. Therefore he did not think it was economy on the part of the Company to connect up any two stations, as was proposed, with a steel main; it should be a cast-iron main of such a size that in future it would supply gas to the town. A return main from the proposed gasholder would also be necessary, because the gasholder must be connected up to the mains of distribution, and it would be most unwise to use a single pipe for this purpose. As to using the very small pipes which were laid in West Worthing at present, far from the works, this would be a great mistake. At present the gas flowed to the westward. The big mains, therefore, were in the east; and whatever gasholder they had, whether it was placed to the west or whether it was placed to the east, the return main ought to come back to the existing works, or else the whole of the arterial pipes (not the smaller ones) throughout Worthing should be altered so as to bring the larger ones to the west end. The cost of taking the return main from the site at Goring to the old works would not be less than £6000 or £7000, because it must be larger than the pipe leading from the old works to the new, as the gas had to be supplied at a much less pressure—only the pressure of the gasholder. Thus the total expense (adding £4000 or £4500 to connect the two stations) would be £10,000 or £11,000. If, on the other hand, the new site were at the east end of the town, a great deal of this would be saved; the mains would be shorter. The general interest of Worthing would suggest the east end. In his opinion, it was a very great mistake to tie up Worthing between the existing nuisances to the east, and another one to the west. The market for their coke was also at the east end, where there were many glasshouses. There would be no difficulty in erecting the proposed works on some of the vacant sites to the east. It was not necessary to be on the main line of railway. There was no reason why the Company should not go, as Eastbourne did, about a mile from the town into the country at the back. As to the proposal to include Goring within the limits of supply, it would be many years before gas would be wanted there. In his knowledge it had never been the practice of Parliament to force gas-works on an unwilling district, nor to force an unwilling district within the area of supply. Both at Tunbridge Wells and at Birmingham they sought to go outside the area in a somewhat similar way; and Parliament declined to allow them.

In cross-examination by Mr. HONORATUS LLOYD, witness said he was in Worthing about 24 hours on this matter. He admitted that he did not meet the Clerk to the Rural District Council or any other official. As to the subsoil at Goring, it was as satisfactory as most of the soil in that district.

Mr. HONORATUS LLOYD: Do you mean to suggest that the subsoil of this site is anything like that at the east end?

Witness: In some parts of the east it is quite as good as it is here, in my opinion.

Did you suggest to your Council to propose a site to the east which we might test?—We cannot go on alternative sites in these rooms, as you know. Therefore we could not propose an alternative site.

Have you any reason to believe that there is an inch of land there that we can get by agreement?—I do not doubt it for a moment.

Witness added that he would guarantee he could buy almost any quantity of land up there. If a site was procured by agreement, they would then have to acquire land for a siding. He knew that Parliament had granted compulsory powers for sidings to gas-works. They did it at South Shields. He admitted that in that case the gas-works had been in existence for years close to the railway, and all negotiations had failed to enable the siding to be made between the railway and the works. He believed that was the only case in which compulsory powers for acquiring land for sidings had been asked.

Witness was also cross-examined as to the Tunbridge Wells precedent he referred to.

Mr. HONORATUS LLOYD: Do not you know that the Corporation of Worthing assent to this proposal?

Witness: Yes; but the Tunbridge Wells Corporation objected.

Do you cite that as a precedent?—Certainly, because the Local Authority of this district object. It is exactly on a par, only it is stronger in this case, because here you are including the district in your limits of supply, for the purpose of putting works there.

You know that if Parliament authorizes us to use this site we are not excused from the nuisance sections in the Acts of 1847 and 1871?—No; but, unfortunately, works cannot be carried on without a nuisance.

Mr. *Joseph Cash* was recalled, at the request of the Committee, in reference to alternative sites. He said he had examined the whole of the line of railway in the borough of Worthing with a view to finding a site. It was absolutely necessary to have a site which had a siding attached to the railway. He could find no such site where the soil was suitable. He had made excavations at Little Chesswood Farm (opposite the Ham Field site) and on two sites at West Worthing, and all revealed running sand in the subsoil. He had overlooked no other site; there was none which he could select and ask for power to inspect.

In cross-examination by Mr. FITZGERALD, witness said he confined his general examination to the land along the line of railway.

Mr. FITZGERALD then addressed the Committee, contending that everything pointed to the east end as the right place for erecting these works, and that to put them in the west was to sacrifice Goring, though in that place the proposal was unanimously opposed.

Mr. *Thomas Bushby*, of West Preston Manor, an old inhabitant of Worthing, examined by Mr. RAM, expressed his opinion that the erection of the proposed works in Goring would greatly deteriorate the value of property there.

Thursday, March 21.

When the Committee met to-day,

Mr. *C. B. Cook* was recalled by Mr. RAM, and pointed out a site at the east end of Worthing close to a point where a well was sunk. The strata through which this well passed was chalk. That was 300 or 400 yards from the railway.

In cross-examination, witness, having in his examination-in-chief pointed out another site with a good subsoil of clay, admitted that he did not know whether the owners of either of these properties would be willing to sell. One of the sites he had referred to was outside the borough boundaries.

Answering the CHAIRMAN, with reference to the site where he had seen a well bored, witness said the chalk and marl went down, to his knowledge, 30 feet; and he considered this a suitable foundation. Of course, they would have to sink trial holes to make sure. He did not know whether this land was in the market, however.

Major *Margesson*, son of Lieutenant-Colonel Margesson, one of the petitioners, said there were negotiations as to the sale of some of his father's land as a site for these works; but after conferring with Mr. Bushby, who energetically dissuaded them, they broke them off.

Mr. RAM then addressed the Committee briefly.

The CHAIRMAN afterwards asked Mr. Honoratus Lloyd in his reply to address himself to the question of an alternative site, which was the chief point left for the Committee to consider. While they might not accept all the opposition had said about the nuisance, still he did not suppose the Committee would, without good reason, pass a Bill which went into the district of another authority who were opposing.

Mr. HONORATUS LLOYD, in addressing the Committee, urged that the promoters had examined all the available sites, but in vain. It was, in fact, against their own interests that they were driven to go out to the distant parish of Goring, because, as Mr. Stevenson had put it to the Committee, this would entail an outlay of some £10,000 or £11,000 in mains.

Friday, March 22.

On the resumption of the proceedings to-day,

The CHAIRMAN stated that he had communicated with the Board of Trade on one or two points, and he had a promise of an answer on Monday afternoon; so that he thought it would be perhaps best to give the Committee's decision on Tuesday morning.

Allegations of Negligence at Pontypool.

The allegations of negligence made against the Pontypool Gas and Water Company formed the subject-matter of comment at the recent annual meeting of the Company. The Chairman (Mr. A. A. Williams) said a point of great importance was the action of the Joint Committee of the Local District Councils, who had been pressing the Directors to enter into negotiations for the sale of the undertaking. The Directors had carefully considered the matter, and had come to the conclusion that it would be unwise to sell. He, however, regretted to inform them that the Pontypool and Panteg District Councils had commenced an action against them for damages, mainly arising, as they alleged, through negligence on the part of the Company in regard to the recent epidemic of typhoid fever. Acting under the advice of eminent Counsel, the Company were taking steps to defend the action. Subsequently, the meeting approved of the action of the Board in taking steps to secure an increased number of springs. Mr. M. A. Bythway, Solicitor to the Company, said the Directors had for some time past been taking steps to materially increase the supply of water. He hoped they would be able to put an end to the complaints of shortage that had been continual for the last few years. They had increased the storage accommodation at the reservoirs from 6 to 13 million gallons. The allegations of negligence on the part of the Directors, and the statements of the public that they were wasting money in paying high dividends, were not justified.

Profits and the Rates at West Bromwich.—The West Bromwich Gas Committee, in a special report, recommend that, in order to avoid an excessive increase of the rates, consequent on the heavier burden of the cost of education, a minute of the Council relating to the apportionment of gas profits in aid of rates be suspended for this year, to enable them to contribute out of the profits of the current twelve months £1000 in relief of the general district rate for the ensuing year. The Electric Lighting and Power Committee also recommend that £800 be granted from the profits of their undertaking in relief of the general district rate.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Monday, March 11.

(*Before Justices* DARLING *and* A. T. LAWRENCE.)

Earl of Carlisle v. Carlisle Corporation.

This was a motion on behalf of the Corporation of Carlisle to send back to the Umpire, in order that he might state a special case, an award which he had made in favour of the Earl of Carlisle, on a claim put forward by him against the Corporation in respect of certain land taken by them for the purpose of their water supply.

Mr. BALFOUR BROWNE, K.C., Mr. E. PAGE, K.C., and Mr. J. T. WOOD appeared for the Corporation; the Hon. J. D. FITZGERALD, K.C., Mr. ACLAND, K.C., and Mr. DU CANE represented the Earl of Carlisle.

Mr. BALFOUR BROWNE opened the case, and his argument occupied a great part of the day; but the real points in controversy may be shortly summarized. The Corporation of Carlisle in 1898 obtained an Act of Parliament for bringing water from certain springs in the Geltsdale valley; the greater part of which was Lord Carlisle's property; conveying it by means of a pipe to a reservoir (not on his Lordship's land), whence it was to flow on to the city. They gave notice to treat for certain small portions of land surrounding the springs in question; and the compensation to be paid was referred to the arbitration of Messrs. Heskett and Fenwick—Mr. John Farrer being appointed Umpire. The arbitration occupied five days; the claim sent in being for £32,000, and being supported by witnesses, who included in their valuation of the compensation payable a sum of £22,888, calculated on the basis of 25 years' purchase of £885 2s. 6d., which was the value per annum of the water. The figures put in by the Corporation included nothing under this head; and Counsel contended that nothing could legally be awarded under it. Nevertheless, the sum awarded—£17,261—must, he said, have included about £8000 for the water, as such a sum remained after allowing for all the other items in full. In the course of the proceedings, he asked the Umpire to make his award in the form of a special case, so that the legal point could be argued. It was expected by everybody that this course would be followed; but after waiting three months the Umpire published his award for a lump sum for compensation for the land taken and for damage to the estate generally.* This was the main point. But there were two subsidiary matters in which Counsel suggested that the Umpire had probably estimated the damage on the wrong basis, though he could not be certain about it, until the case was stated.

Mr. FITZGERALD argued at considerable length that the award ought not to be sent back, and that, though his witnesses had reckoned the damage on the basis of so many thousand gallons of water at a certain price, he had made it quite plain in his speech that he did not claim for the sale of water, but for damage to property; the figures being given only as a basis of calculation. His contention was that the property, from its position, elevation, and surroundings, was very valuable as a water-bearing property, which other municipalities might be willing to acquire in its entirety as a means of obtaining a supply, especially as there were upon it natural reservoirs, as he might term them, which would save a great deal of expense in the construction of works. But such a sale was entirely prevented by the Corporation's Act; because it was not to be supposed that Parliament would grant any other public body the right to take water which was already allotted to Carlisle.

Mr. ACLAND urged that, under the circumstances, the Court had no power to send the award back.

Justice DARLING, in giving judgment, said that on the two minor points—the approach to the stream and the sheep-washing place—there was no ground for sending the award back; but on the other and more important point, as to the principle on which the compensation was awarded to Lord Carlisle for the injury done to his property, he thought it should go back. There was sufficient ground made out for coming to the conclusion that the Umpire should have stated a special case. Early in the proceedings, Mr. Balfour Browne stated his objection to the mode of assessing the compensation which was being put forward by those representing Lord Carlisle. One of the witnesses put it as "water taken, average daily yield, so many gallons, at ¾d. per 1000 gallons, £2 8s. 6d. per day." This was multiplied by 365, to give the year's value, and then by 25 years' purchase; and Mr. Browne asked the Umpire, if he decided against his contention, to put his award in the form of a special case, so that it could be tested in Court. What he put forward then, as he did now, was that, instead of considering generally what was the damage to the property, a claim was put forward which depended on the quantity of water taken, just as if it were a commodity which Lord Carlisle was selling to the Corporation. In his final speech, he again alluded to it; and it appeared to him that the arbitration concluded with the expectation by the Corporation that a special case would be stated. Further, the evidence offered by the claimant's Counsel plainly asked the Umpire to award compensation on the wrong basis. It asked him to compute the damage done to the property precisely as though the coal were being taken out from under his land, and this not only in dealing with the springs which the Corporation had a right to take, but with running water on the land which they they did not take at all. It was said that he had there a large piece of land the whole of which he might have sold to some other corporation, because there was water on it; but the Corporation of Carlisle had taken some of it, which diminished the supply, and so he was entitled to go into a calculation and show that he had lost all, because he could not sell to anyone else what the Corporation had not taken. Mr. Fitzgerald, seeing how fallacious that was, tried to get out of it by calling it "compensation for injury." But it did not make it any better by saying: "I put it as though we were selling the water at so much per 1000 gallons; but I know that would be wrong,

* See "JOURNAL," Vol. XCIII. p. 749; and Vol. XCIV., p. 716.

so I do not call it the price of water, but compensation." The proper way would have been to have stated how the compensation was arrived at; and therefore the Umpire should state exactly what he had done in the form of a special case.

Justice LAWRENCE gave a short judgment to the same effect.

The costs of the application were reserved.

We learn that Lord Carlisle's Solicitors (Messrs. Bircham and Co.) have given the Town Clerk of Carlisle (Mr. A. H. Collingwood) notice of his attention to appeal against the decision above recorded.

EDGWARE PETTY SESSIONS.—Wednesday, March 20.

(*Before Mr.* J. E. LILLEY, *Chairman, Mr.* ACTON DAVIS, *and Mr.* C. R. NUGENT.)

The North Middlesex Gas Company Prosecuted for Alleged Deficiency in Illuminating Power.

To-day the North Middlesex Gas Company were summoned, at the instance of the Hendon Urban District Council, by Arthur William Mitchell, the Gas Examiner to the Council, for having, on Aug. 31, Sept. 26, Oct. 25, Nov. 7, and Dec. 3 and 17, 1906, and the 17th of January last, supplied to the testing-station, at the offices of the Council, gas of less illuminating power than 15 candles, contrary to the provisions of the Gas-Works Clauses Act, 1871, and the North Middlesex Gas Acts, 1895 and 1903.

Mr. COLQUHOUN DILL (instructed by Mr. E. Bevir) appeared for the Council; Mr. R. S. CLEASE (instructed by Messrs. Merrimans and Thirlby) represented the Company. Professor Vivian B. Lewes, Dr. Harold G. Colman, and Mr. G. C. Trewby were in attendance to give evidence on behalf of the Company.

Mr. DILL, in opening the case, said the Company's Act of 1903 contained a clause requiring the District Council to provide a testing-place and the necessary apparatus and machinery for testing gas, but previously it had been an obligation on the Company to maintain a testing-station to which the officers of the Council had access during the tests. Counsel then handed in voluminous correspondence which had passed between the Council and the Company, beginning in 1904 and continuing until the present year; and he read one or two letters to enable the Court to better understand the history of the case. He said the correspondence showed that the Company put forward four contentions: First they said the Council's officer had been testing stale gas, because insufficient was allowed to burn before the test began. The Council's answer was that the gas had been allowed to burn from six to eight hours before it was tested; and the inference was that this was a more than sufficient time to consume all stale gas in the service-pipe, and that it more than complied with the Act of 1871 and the regulations prescribed by the Metropolitan Gas Referees. Moreover, the Council said the gas had been burning two whole days preceding the test made on Dec. 17. The second contention of the Company was that, owing to the low temperature in the testing-station, the tests were not reliable. The Council answered this suggestion in the same terms—viz., that prior to each test the gas was allowed to burn for some hours; and if there had been any defect or exceptionally low temperature it would have been set right by the aërorthometer, which corrected the actual temperature of the room. The third contention was that insufficient notice had been given to the Company's officer of the intention to test. The Council's reply was that notice had been given of all the tests, and that the Company's officer had been present at five out of the seven dates on which complaints were made. The fourth contention was that general access to the testing-station should be given to the Company's officer at all times, as provided for in the Gas-Works Clauses Act, 1871. The answer to this was that no such right of general access was provided by the subsequent Acts, but only a right to be present when tests were actually being made.

The CHAIRMAN suggested that, as the Company had the right of free access under the Act of 1871, the same right would exist under the Act of 1903.

Mr. CLEASE said both parties had free access under the old Act, and the same powers existed under the new one.

Mr. DILL contested this statement. Proceeding to further refer to the correspondence, he said the Company insisted in January, 1906, upon a gas-testing apparatus in conformity with the requirements of the Gas Referees being fixed, and the demand was complied with. Later there was a request from the Company that the Council would allow their Engineer and Chemist to have access to the testing-station at other times than during the official test, in order to investigate the cause of the discrepancy between the Council's and the Company's tests. The Company pointed out that the difference might be due to several causes, but they were quite inexplicable without a thorough test. On July 24, 1906, the Council wrote that, unless steps were taken by the Company to supply gas in accordance with the terms of the Act, proceedings would be instituted; and they also stated that the Council could not offer the Company further facilities for testing the gas at the station. The Company wrote in reply that the Directors repudiated in the most emphatic manner the suggestion that the Company had failed to supply gas of the required standard. Coming to the final stages of the negotiations, Counsel said the test made on Aug. 31 last showed the illuminating power to be at 6 p.m., 14·17 candles; at 6.20 p.m., 14·25 candles; and at 7.30 p.m., 15·44 candles.

Mr. CLEASE: Which proved conclusively that the examiner was testing stale gas.

The CHAIRMAN: There is another answer.

Mr. CLEASE said he was going to give all the reasons. This was conclusive evidence that as soon as the stale gas in the supply pipe was exhausted, and the gas was drawn direct from the main, a higher standard was attained.

Mr. DILL said this was not the construction put upon it by the other people. The Council had been long-suffering in the matter, and had given the Company the fullest warning; and now, after a long delay, they were compelled, in order to get an adequate light in accordance with the Act of Parliament, to proceed by summons. He asked the Court for a substantial, though not a vindictive, penalty.

Evidence was called in support of the summons.

Mr. *A. W. Mitchell* said he had been one of the Gas Examiners for the London County Council for sixteen years; and he received the appointment under the Hendon District Council on Oct. 24, 1904. He made the tests which formed the subject of the present proceedings. The exact candle power on the given dates was as follows: Aug. 31, 14·6; Sept. 26, 14·49; Oct. 25, 11·81; Nov. 11, 14·30; Dec. 3, 14·21; Dec. 17, 14·28; Jan. 17, 1907, 13·76. The usual time for making tests was between 6 and 8 p.m. The room was kept at a temperature varying between 55° and 65° Fahr. The tests were made in conformity with the regulations of the Gas Referees, and the apparatus was in conformity with their requirements. A representative from the Gas Company was present at all the tests up to the 25th of October. Witness usually gave the Company an hour's notice by telegraph of his intended test. Their representative did not at any time suggest that the test was being improperly made, that the apparatus was not in order, or that stale gas was being tested. The gas was lighted eight hours before he made any of the tests; and stale gas, in the length of pipe in this case, would have been consumed many times before he began. The London County Council's regulation prescribed 15 minutes for burning out stale gas. Prior to the test of the 17th of December, the gas was burning two days, and an unofficial test was made on the 15th and 16th. He occasionally found the gas exceeding the standard power.

In reply to questions put by the Bench, witness said the testing-room was heated by hot air, and was never below 55° Fahr. The place was ventilated by gratings in the wall, and the door opened into the main hall. If the air had been vitiated, he would have perceived it.

Cross-examined by Mr. CLEASE, witness said the door was very often open during the tests, some of which were made in the dark. The gas was burnt through the meter in order to clear the service-pipe of dead gas. The tests were made once a month; and in the meantime he knew nothing whatever about the meter or apparatus—he did not know whether or not it was meddled with. He believed the Council had since 1904 consumed 3300 cubic feet of gas in making the tests; and he was prepared to believe that the Company had consumed in the same period for the same purpose 72,200 cubic feet. The book produced contained a record of the result of his tests. He usually gave the Clerk to the Council a day's notice of his intention to test the gas, and the Company, who were vitally interested, an hour, or it might be half an-hour's, notice by telegraph. He had not received instructions to give the Company longer notice.

Mr. CLEASE: Why cannot you give the Company notice at the same time that you notify the Council?

Witness: I have a reason. If I gave 12 hours' notice, they might improve the gas, which they were quite capable of doing, and raise it above the standard. What then would be the good of my test?

Cross-examination continued: He did not know whether his notice had ever arrived too late in the evening to receive attention. He did not intend it to be too late, and he was sorry if it had ever been. He was not aware that the result of the Company's test on Aug. 31 was 16·04-candle power, whereas the Council's test was 14·6 candles.

Mr. CLEASE, after examining the record, pointed out that on the 31st of August the figures in the book did not agree with those already given before the Court, and said it was a most extraordinary thing that they had never been corrected.

Mr. DILL said the mean average was the same—14·6 candles.

In further cross-examination, witness said he did not agree figures with the Company's representative. He merely gave him the figures, and he entered them in a book; but whether or not this was done correctly he (witness) was quite unable to say. If his figures differed, the representative could not have entered them correctly. The testing-station was provided with a thermometer, but not with a barometer, though it was one of the regulations of the Gas Referees that they should keep both. He sometimes took the reading of the barometer out of the newspaper. (Laughter.) Witness was then taken through the various results of tests, and asked what he thought would happen to the gas-stoves and the light with an ordinary burner if the illuminating power was only 11·81 candles, as stated on the 25th of October. He said the light would be very bad, but he had not studied the question of gas-stoves. He did not know whether there would have been hundreds of complaints. People often complained to one another, but did not write to the gas company. He had never managed a gas company, and could not speak from knowledge. He was not aware whether the Council complained of the light on that particular night. They might have complained. Once he told the representative of the Company that the meter gave him a lot of trouble; but this was accounted for by the fact that at a particular spot a little water accumulated, which he always cleared away before making a test. He had not heard that the Company complained that the tests were intermittent, but he was aware that they thought the gas should be burnt continuously. He had not heard that the Company offered the gas free in order that the tests might be made real. Apart from clearing the pipe from stale gas, there was no other trouble. The fact of the apparatus remaining idle for two or three weeks might produce naphthalene under some circumstances. He could not say that the testing was wrong if it did not comply with all the requirements of the Gas Referees.

Mr. CLEASE: The Gas Referees require that the testings for illuminating power made with a standard argand burner shall be three in number daily, at intervals of not less than one hour.

Witness said he took that to mean three times on the day the test was made, but not a daily test.

Mr. CLEASE asked if one single test had been made in accordance with the regulations of the Gas Referees, and therefore whether there had been one reliable test.

Mr. DILL (interposing) said these regulations referred to the Gaslight and Coke Company and the other London Companies, but not to a place like Hendon.

Mr. CLEASE said the clauses were in the 1871 Act, and the Company had power to adopt them—in fact, did adopt them.

Mr. DILL said the point had not been raised in the correspondence. Nothing had been said about a daily test.

Mr. CLEASE replied that the fact that the Company had not found fault did not prevent them from raising the point before the Court.

The CHAIRMAN said the Bench were of opinion that the regulations affected the tests.

Mr. DILL said it would be wrong to argue that the 21st clause of the regulations of the Gas Referees applied to Hendon, because the latest Act did not say how the test should be carried out. To say it applied to Hendon was to say it applied to every district.

The CHAIRMAN thought that the regulations referred to must be applied to all Acts of Parliament relating to gas testing which incorporated them—that was to say, they could not be applied partially, but must be applied in their entirety.

Mr. DILL contended that the regulations were made for London, and were intended to apply to London and not outside.

The CHAIRMAN: It must have been in the minds of the Referees that they should apply to all.

Mr. DILL said that clause 21 applied to London. If this clause was incorporated in the Hendon Act, why not all the other regulations in force in London?

The CHAIRMAN asked if Mr. Clease wished to go on with the evidence, or whether it was probable the case might be taken to another Court.

Mr. CLEASE said they would take the case to the House of Lords if necessary. There was no appeal on the question of fact; and he could defeat the other side on fact, which he preferred to do. His clients would rather go on with the case.

After further examining the Act of 1905, the Magistrates stopped the case.

The CHAIRMAN asked whether, in face of their reading, they could go on. He added that Mr. Dill had fought the case as far as he could, and Mr. Clease had established to their satisfaction that it could not go any farther. The summons would therefore be dismissed.

Mr. CLEASE then raised the question of costs. He said it was a bad case. For two years the Company had pointed out that the test of the gas was not a proper test.

The CHAIRMAN said he was sure the Council had no intention of persecuting the Company. What costs were claimed?

Mr. CLEASE said he was advised that the Company's costs would exceed 100 guineas. The Company had intended to carry the case to the House of Lords, and therefore brought down from London experts such as Professor Lewes, Dr. Colman, and Mr. G. C. Trewby.

The CHAIRMAN said, on looking at the witnesses whose names had been mentioned, the sum was not large. He asked Mr. Clease if he would say 75 guineas.

Mr. CLEASE assented, and the costs were entered at this amount.

LAYING MAINS UNDER FOOTWAYS.

At the Edgware Petty Sessions last Wednesday, the Hendon District Council were summoned, at the instance of Mr. Lawrie Trewby, the Engineer and Manager of the North Middlesex Gas Company, under the following circumstances: A difference had arisen between the Council and the Company respecting a plan, according to which the soil and pavement of Finchley Lane were proposed to be taken up and a gas-main laid therein, and the Council had objected. The Company were therefere desirous that the matter should be determined by two Justices, as provided by the Gas-Works Clauses Act, 1847. Mr. Clease, who appeared in support of the summons, contended that the Council could not dictate to the Company. They could disapprove of a plan and suggest an alternative; but this was not the attitude that they had taken up, as evidenced by their letters. Counsel put in a plan showing the position of the proposed main under the footway; and, after commenting on the correspondence, he argued that no reason had been stated by the Council as to why objection should be raised to the Company placing the pipe as shown. He called Mr. Trewby, who said the path in Finchley Lane at the point indicated was 11 ft. 6 in. wide; and if they carried the main down the highway, the path would have to be opened up in the case of each house. It was the policy of gas companies to lay their mains under the footways. In cross examination by Mr. Colquhoun Dill, who appeared for the Council, witness said the cost of laying the main in the road would be higher than if it were laid under the footpath; and the consumers would pay for it. He was of opinion that it was easier to reinstate an asphalte path than a road trench, if the paving was properly laid. Once laid, it was rarely, or never, opened for repair; but when a main was laid under the highway, they were constantly opening the road to effect repairs. The Chairman (Mr. J. E. Lilley) said the Bench were of opinion that the Local Authority had control of the highway, and that the Justices would not interfere in the matter unless they were withholding some power for a fanciful reason. If this observation would help the present parties to come to an agreement, he threw it out. Mr. Clease said he would show that the Gas Company's views were not fanciful. He then called Mr. J. Anthony, their main-laying foreman, who said his 18 years' experience was that the leakages caused by vibration and settlements when mains were laid in roads were a source of great expense. In the present case, there was an element of great danger in the electric cable. Mr. S. S. Grimley, the Engineer to the Council (in answer to the Chairman), said they considered that in certain cases, especially as in this one, where there was only one footway in the road, it would be far less inconvenient to the general public if the mains were laid under the carriage way. The Council generally objected to mains being laid under the footways. The Chairman said the Council were the rightful custodians of the roads, and unless it was shown that they were acting unreasonably in their requirements, they ought to be supported in their action. The Court, in this instance, did not think they were acting unreasonably; and therefore they sustained them in their decision. Mr. Dill asked for costs; but Mr. Clease objected, on the ground that the Company merely came to the Court to assert a right. The Chairman said the Bench were of opinion that the parties should pay their own costs.

MISCELLANEOUS NEWS.

NOTTINGHAM GAS INQUIRY.

The Fourth and Fifth Days' Proceedings.

The Committee of the Nottingham City Council appointed to inquire into the working of the gas undertaking during the past five years, sat on Tuesday and Thursday last week. The members of the Committee are: The Mayor (Alderman J. A. H. Green), Mr. E. L. Manning, Mr. S. Cook, Mr. E. N. Elborne, and Dr. Dabell.

The MAYOR, at the opening of the proceedings, said he had received a letter which suggested that he acted as Mr. Harlow's legal adviser up to and during the proceedings of the late Investigation Committee; and that, therefore, he ought not to take a leading part in this inquiry. He explained, however, that he had not in any matter been Mr. Harlow's legal adviser; but that one day he was asked (he did not know by whom) if he would go and meet Messrs. Harlow, Sands, and Jelley in the Town Clerk's room. On arriving there he learned that the Town Clerk had written to each of these gentlemen asking if they would consent to his giving a copy of a statement made by Mr. Brown to each of the others, though the statement might contain reflections on themselves. He (the Mayor) was asked his opinion as to the course that should be taken. With the consent of the three gentlemen, the Town Clerk showed him what Mr. Brown had said about them. He suggested that Messrs. Jelley and Sands might very well authorize Sir Samuel to give Mr. Harlow three copies with which he could do as he pleased. This would get over any question there might be of publishing any libellous matter. The suggestion was acted on. He supposed his opinion was asked as one who was detached from the quarrel.

The other members of the Committee having expressed confidence in the Mayor, and Mr. Brown having acknowledged the kindness and consideration he had shown towards him, copies were put in by the latter of tables showing the amount spent out of revenue on repairs during the last five years and the capital outlay, and the candle powers and the complaints per 1000 meters during the same period.

Mr. *J. H. Brown*, the Engineer, was then asked how the plant at Eastcroft had been manipulated during the later months of 1905, in connection with the irregularities referred to at the previous sitting. He replied that the seals had been lowered in the retort-house, and the exhausters had been run at a higher rate than was reasonable, producing a greater quantity of gas per ton than would yield a satisfactory candle power. Lessening the seals would not necessarily admit air into the retorts; but it would lead to the introduction of furnace gases in some cases. A higher candle power than was actually being made had been entered on the records at the works. During the months of September, October, and November, 1905, some 2000 more complaints were received than in the corresponding months of the previous year; whereas for the whole of the year the increase was only 1300. Instructions at the works would be received from the works foreman, whose subordinates would not accept responsibility for what they were doing. Suction could not now be increased beyond the amount controlled by the automatic apparatus. The gentleman who made the statement to him about what took place at Eastcroft, had occupied the position of Assistant Engineer at a London Suburban gas-works before he came to Nottingham on witness's recommendation. Witness had full confidence in him before this discovery was made. He left a few months afterwards. He could not say for the moment whether he had a testimonial when he left. He did not think he had one from the Committee. Until Dec. 9, witness had no knowledge whatever of this falsifying of the records or tampering with the plant. It was criminal folly on the part of any gas engineer to have done anything of the kind. They commenced to put blue water gas into the mains some time in 1903, and continued to December, 1905—only from the Basford works. The biggest proportion in any one day was 8·06 per cent., some time in July, 1905. Complaints were low during that period. They never made carburetted water gas in sufficient quantities to register.

By Mr. COOK; Water gas could not possibly have had anything to do with the complaints. During the two years they were using water gas, complaints were low. The blue water gas would most certainly mix properly with coal gas, because it contained practically the same constituents as coal gas, only in different proportions. It was impossible for even a chemist to detect the presence of a small proportion of blue water gas.

The MAYOR read an extract of a report by Mr. Harlow, in which he said that, in a conversation he had had with Sir George Livesey, he told him (Mr. Harlow) that it was most difficult to mix blue water gas with coal gas. It was like mixing oil with water. The blue water gas would float about the mains in patches.

Witness said he had never heard of such a suggestion from any other source; and he referred to undertakings where as much as 50 per cent. of water gas was introduced into the mains, without any serious complaint. Nottingham, he said, was doing nothing very extraordinary in adopting blue water gas.

Dr. DABELL said he would like to definitely ascertain the reason for the Engineer's advocacy of the carburetted water-gas plant.

Witness replied that it arose from the question of storage. The water-gas plant actually took the place of a holder; and the first cost of the water-gas plant was less than the first year's interest on the amount required for the erection of a gasholder of sufficient size. The plant was also of great use in case of a sudden demand when there was fog. He would not recommend carburetted water gas as economical for regular production, but only in special cases. The effect of blue water gas used in excess was to reduce the illuminating power of the gas. Blue water gas, however, might be used up to the proportion of 30 per cent. without materially affecting the light. Where it was used in great quantity, it was possible to increase the illuminating power of the gas by having a benzolizing plant on the site. The greater cheapness of blue water gas would more than pay the consumer for laying down the benzolizing plant. The amount of blue

water gas used in Nottingham, however, could not possibly have decreased the illuminating power of the gas or given rise to any complaints of the indifferent lighting of lace factories.

Witness next went on to speak of the complaints received during the fatal December. On investigation of the complaints, he said, it was found that they appeared to be localized—that the troubles occurred in "patches." One day four or five complaints would be received from the Meadows, another day from as far away as Bulwell. The gas sent out at one time, it was concluded, would go to one place; and the complaints were generally as to the quality of the gas in the morning. Further inquiries led to the eventual discovery of the fault at Eastcroft. A system of tabulating the complaints was introduced in March of last year; and of those received, 12,600 were to be traced to the Corporation, while 3500 were to be traced to the consumers. Complaints were also made of lamps being out in the morning—this being due either to the fluctuation of quality or to the pressure, which at midnight was very greatly reduced. Complaints were still received; but when the number was compared with that of other towns, the comparison (despite the difficulties which the varying altitudes of the city presented) was not at all unfavourable to Nottingham. As regards the present method of dealing with complaints, he was not contented, principally because the clerk who received them had not the technical knowledge necessary to question the consumer. At the time so many complaints were being made, witness recommended certain proposals for dealing with them; but the recommendations were not prepared at the request of the Gas Committee. He personally investigated the complaints; and feeling that the matter was not being satisfactorily dealt with, he prepared the recommendations, in the hope that the Committee would discuss the question. The recommendations were not, however, acted upon.

The MAYOR: I suppose the Committee were at their wits' end to know what to do.

Witness: Yes.

Mr. MANNING remarked that, though the matter was of such importance, the recommendations were not considered by the Committee.

The MAYOR: They were in too great a panic to consider anything in cold blood. Continuing, he said they were all conscious of a great outcry; and he asked witness if he could give a reason for this.

Witness replied that it would be difficult to summarize the cause. In every undertaking of the description of the gas-works, there were panics at one time or other; and it was almost invariably soon after the notification had been made of a reduction of candle power. The matter, to his mind, was brought to a head by the statement in June, when a deputation of the Chamber of Commerce were before the Gas Committee; and they were told that the candle power was reduced, and that a further reduction, rather than an increase, was likely to take place. After that all complaints, from whatever cause, were put down by the public to bad gas. There were many complaints quite justified—caused by the irregular pressure of the gas interfering with the working of meters, by the presence of naphthalene, and by the bad gas produced at Eastcroft.

The MAYOR: Do you think that the sudden reduction of the candle power had anything to do with the complaints?

Witness: Yes; where there were unsuitable burners.

The MAYOR: I am going to put before you an idea which I have been rash enough to have. If the Gas Committee had taken the bull by the horns, and for the first six months after the reduction of the candle power had undertaken to deal with the consumers' fittings, and after that left them to the trade generally, we should have had many fewer complaints.

Witness: We should have had no complaints at all—or very few.

The MAYOR said he had received a communication from a member of the public, who suggested that one of the reasons for the complaints as to defective supply was the corrosion which so quickly took place in the ¾-inch pipes from the mains to the meters.

Witness replied that out of the 12,000 complaints received during the last twelve months, 4092 were due to defects in service-pipes. These pipes were made of wrought iron, which was more susceptible to corrosion than the cast-iron main-pipes. Corrosion was inseparable from all gas supply. With regard to shutting down on Sunday during the summer months, he had instructions from the Chairman to do so before it had been brought before the Committee. The Committee afterwards confirmed the Chairman's action. The shutting down was done in direct opposition to his (witness's) advice.

The MAYOR: Whatever result came from this policy is not Mr. Brown's fault.

Witness then explained his views on reduced candle power. He said the reduction not only benefited the Gas Companies, but the consumers, in London, where the power had been reduced practically 5 candles below that of Nottingham. Candle power was only of importance to that small proportion—20 or 25 per cent.—of the consumers who continued to use flat-flame burners; and for these, the remainder of the consumers must suffer, both in the price of gas and in efficiency. The majority of the flat-flame burners in use gave only about 40 per cent. of the illuminating power of the gas; and he thought if more suitable burners were employed, the candle power might safely be further reduced.

Mr. *W. Garton*, the Gas Accountant, was called with reference to Mr. Brown's suggestion that all complaints should be forwarded direct to him (Mr. Brown). Witness said he had acted in the capacity of Accountant for the past 24 years. During that period, the method of receiving and attending to complaints had remained the same; and he thought it undesirable to alter it. If the complaints did not go to him in the first instance, the figures might be suppressed, and they would be a financial failure. It was possible to check the complaints if they were handed in to him and then passed on to the Engineer's office.

Mr. ELBORNE maintained that it would be better for complaints to be entrusted to men with technical knowledge, rather than to clerks.

Witness replied that he had always found the latter fully capable of dealing with the complaints.

The MAYOR: It looks to me like the case of a sick man going to the doctor's book-keeper, instead of to the doctor, to tell him what his complaint is.

Witness: I hardly think so.

Henry Whetton, a foreman at the Eastcroft works, was the first witness on Thursday. He said that his superiors were Mr. Brown, the Superintendent, and another foreman named Worthy; but Worthy and himself were in charge on days and nights alternately. He took his orders from the Superintendent. During a portion of 1905, there was some falsifying of records as to candle power on the jet photometer; but the same thing did not apply to the bar photometer. Whatever the readings of the jet photometer were, they were booked at a certain point. This was done with the full knowledge of the Superintendent, who set the jet, and who could see that the readings were booked higher than was justified. Several times the Superintendent sent back the records for alteration before he forwarded them to George Street, when they were not what he wanted. So far as witness knew, Mr. Brown was always aware of the instructions given to him; but he had no proof that this was so. Mr. Brown never saw a false record made, so far as he knew. Witness also spoke of the lowering of the seals during certain hours of the night. This was done by the "whistle blower," who received his instructions from the foreman on duty. The foreman was told never to let the light get below a certain point on the jet photometer—about 10 candles. When what they were doing was discovered, witness saw Mr. Brown and Mr. Harlow about it. He had worked there about eighteen years; and nothing of the kind had been going on under any other Superintendent.

Samuel Worthy said he had been foreman at the Eastcroft works for four years. He was cognizant of the falsifying of the figures; and instructions for doing this were given to him by the Superintendent by word of mouth. The instructions were not to book the jet below 15 candles; and this practice continued until the matter was discovered. He had no fact or evidence to show that anyone other than the Superintendent knew of this. The orders given in the daytime were given to the men on day duty; but as far as he knew, the seals were not lowered during the daytime.

Henry Hide, engine-driver at Eastcroft, said that weights were put on sometimes by the foreman; and when a certain period had elapsed, they were taken off again. The Superintendent was about the place when this was done; but so far as witness was aware nobody besides the engine-driver knew what was going on at night, because the Superintendent came down once and said: "What are you on with? I cannot see in the house." The practice of putting on weights was going on for two years previous to 1905. He thought that the more the people agitated, the worse the gas became. The practice was adopted soon after the new Superintendent came; and sometimes he (witness) thought the gas could not have been above 1-candle power.

Joseph A. Simpson, who became an engine-driver at Eastcroft four years ago, said that during the latter part of 1905 instructions were given to weight the engines to keep them in their proper travelling. Weights were put on sometimes by the Superintendent—this being during both the day and the night shifts.

Mr. *Brown* explained that there was nothing unusual about the weights.

F. B. Hutchinson, another engine-driver, also spoke to instructions being given to keep the candle power up to a certain standard. In the daytime the standard was 15 candles, and at night a little less.

Mr. *Garton* was then called again, and presented his report on the subject of complaints. Questioned with regard to an allowance for incorrect registering on an account with the Railway and General Engineering Company, who at their new premises had had since 1901 a 1000-light main meter and several smaller ones, witness said that the Corporation charges for gas were made out from the 1000-light meter. The Gas Committee had received complaints that the meter had been registering for four or five quarters a larger amount of gas than had been consumed; and the department had a complaint of overcharge from the Company in the summer quarter of 1905, when they deducted £16 from the account as a protest that the charge was excessive. This sum was, however, afterwards paid. When the bill for the September quarter was due, there was another complaint; but by this time the meters were being tested. The test of the meters showed that the main meter was 2·68 per cent. fast, and a 30-light sub-meter was 8·45 per cent. fast. That was to say, the meters were registering against the consumer; and in consequence there would be an overcharge. The Engineer afterwards communicated with him, saying he could not settle the matter with the Company; and it was left in the hands of the Chairman of the Gas Committee. Personally, he made no calculation of the amount of the overcharge, because the Chairman was dealing with the matter. Later, he saw Mr. Harlow, at the latter's request; and the Chairman told him that he had settled the question for a £35 allowance. The basis for this calculation, he presumed, was an allowance of 2·68 per cent. on the gas consumed since the meters were put down in 1901. The amount paid by the Company during that time was £1395. Making the 2·68 per cent. allowance for the whole time, the overcharge would be £37; and he thought that the allowance of £35 was a wise and not an excessive one. There had been complaints during the whole of the time the meters had been installed, though it was not until the June quarter of 1905 that the Company had stopped anything in payment of the account. They had previously had similar applications for an abatement from other customers. In cases where the meters were found to be wrong, it was usual for a consideration to be made for two quarters. There was, however, no rule.

The MAYOR: Why did not you have the matter brought before the Committee, and have a minute on the books? That is where all the trouble has been, I think.

Witness: I did not recognize it as my duty to bring such a matter before the Committee; but I should do so now. The Committee first heard of what the Chairman had done from the report of Mr. Mark Mellers, one of the Elective Auditors. Questioned by Mr. Harlow (who was present at the inquiry), witness said an allowance of more than two quarters had been made in the case of Messrs. Taylor Bros., of Sandiacre.

Mr. *Brown*, on being interrogated as to the matter, said the custom of the department was to allow a percentage off the quarter in dispute. The department took every reasonable precaution; but it was impossible to tell exactly when a fault occurred. There was no case on record where more than two quarters had been allowed on the certificate of a test. The first complaint he had from the Railway and

General Engineering Company was on July 1, 1905, though others might have been made without his knowledge through the Accountant's office. On Dec. 15, a leakage was discovered in one of the meters (a 200-light one); but this was entirely due to faulty work by the Company's own men. Immediately the two main meters were tested, he wrote to Mr. Crosta, as representing the Company, asking for a copy of the certificate, which he duly received, along with a statement showing Mr. Crosta's estimate of the gas over-registered by the two meters, which was worked out to show an equivalent of £48 2s. 11d. Witness thought the amount was excessive. In his opinion, £4 or £5 would have been an ample allowance for the two quarters—the current quarter and the one in dispute. The matter was discussed, but no agreement was come to; and Mr. Crosta asked him if he were willing to leave the question in the hands of the Gas Committee. The next occasion witness heard that the bill had not been paid was from Mr. Garton; and witness informed the latter that the matter had been left in the hands of the Chairman. At a later date Mr. Harlow came to him, and witness said that, in his opinion, the request for an allowance of £48 was an excessive one. Mr. Harlow said he would deal with the matter with Mr. Garton, and took the papers away with him. Eventually he learned that a sum of £35 had been fixed upon. Asked whether he had ever before seen certain documents produced by Mr. Harlow, witness said he had no recollection of having done so. He also said he did not think that certain pencil figures on them were those of any member of his staff.

Mr. *Edward Harlow*, who next gave evidence, said that unfortunately he was Chairman of the Gas Committee during the period they had just been dealing with—1905. He was Auditor to the Railway and General Engineering Company; and he had 50 £1 shares in the undertaking, the capital of which was £80,000. Witness produced papers (which he said were for some time lost), which gave the basis of the Company's claim against the Gas Department. The original claim was £70; but it included loss of time, foreman's wages, and so on. The actual figure for excess registration was £48 odd. Mr. Brown gave him the document containing the claim, and intimated that the dispute was acute between himself and Mr. Crosta. He asked witness if he would endeavour to bring about a settlement. He gave witness the idea that the claim was substantially correct; and the reason he was able to say that was because of pencil figures on the paper. Those figures were the figures of a clerk in the Gas Office; and they substantially agreed with the amount of the claim.

EDINBURGH AND LEITH GAS COMMISSIONERS.

Annual Meeting—Annual Dinner.

The Annual Statutory Meeting of the Edinburgh and Leith Gas Commissioners was held on Monday of last week—Lord Provost GIBSON presiding. The business was altogether formal, and the meeting lasted only about a minute and a half.

On the evening of Wednesday, the Commissioners held their annual dinner, at which the Lord Provost again presided. Beside him were four ex-Lord Provosts of the City of Edinburgh—Sir Jas. Russell, Sir Andrew M'Donald, Sir M. Mitchell Thomson, and Sir Robert Cranston—all of whom were Chairmen of the Gas Commission when they were in office. The gathering was this year in the Royal Hotel. There was a company of about 100 present.

Lord Provost GIBSON said he would not read the letters of apology for absence; but he would like to refer to the absence of their Engineer—Mr. W. R. Herring. They regretted the cause of his absence, which was ill health. He had left that day for the South of England, and they hoped his sojourn there would restore him to good health.

Mr. R. MILLAR, the General Manager of the Caledonian Railway Company, proposed the toast of "The Gas Commissioners." He said his first connection with gas-works was about fifty years ago, when his grandmother used to send him—a very little boy then—to Stirling to collect the dividend upon a few shares which her father had held in the Stirling Gas Company. He remembered that in those days the most approved method of discovering a leak of gas was by turning a newspaper into a sort of torch, about a yard long, and going with it lighted to the meter. His grandmother did that. He remembered that for the next fortnight she lay in bed, with her countenance adorned with cotton wadding and olive oil; and she gave him a bit of advice he never forgot—never to look for an escape of gas with a lighted newspaper, but to be content with a lucifer match. In later days gas makers had had to compete with various competitors. At one time it was thought that water gas was to be a formidable rival of coal gas; but water gas, he thought, must have been drowned in its own element. Then there was acetylene gas. Perhaps the most formidable rival coal gas had ever had was electricity; and for a time he thought that the period of coal gas was gone. But he was re-assured, on reading a few years ago a speech by the then Assistant Gas Manager in Glasgow, in which he said that the more electricity was used, the more coal gas was used. There was one thing which was greatly to be admired in the Gas Commissioners of Edinburgh and Leith; that was the amount of faith in gas they had displayed, and the courage they had shown, founded on that faith. That they believed in the permanence of the article they produced was shown, he thought, by the construction of the magnificent gas-works at Granton, which were the marvel, he might say, of Scotland.

Judge BRYSON, the Convener of the Works Committee, acknowledged the toast, and said he could assure them that, notwithstanding the competition with electricity, the increase in the consumption of gas had been this year very marked. Gas, as they knew, was now burned in a very different manner from what it used to be. The spread of incandescent lighting had given a great impetus to the gas industry. At the last collection of their gas accounts they had a census taken of the persons who were burning gas in incandescent burners; and they found that, particularly in the working-class districts, over 70 per cent. did so. Gas-fires and gas-cookers had also helped to swell the gas consumption. As they knew, the Commissioners opened a new section of the works at Granton in October last; and he was pleased to say that they had given them every satisfaction. They were now in a position to meet any increase in the consumption of gas which might occur within the next ten years. They had begun to dismantle the plant at the New Street works; and the site of the works would soon be in the market for sale. Craigleith Quarry, which they purchased some time ago for a water supply, was giving them a sufficient supply of water for all purposes; and the water in the quarry had not diminished but increased. The state of their whole undertaking was due, he was bound to say, to the very able manner in which it was managed by their Chief Engineer, Mr. Herring. He was sorry that he was not with them that night, owing to his health having been a little run down; but he hoped he would soon recover, and be able to resume the good service he had given them.

Mr. R. MENZIES, the Convener of the Finance and Law Committee, also acknowledged. They had, he was glad to say, very little law business. The financing, so far as the Convener was concerned, was an easy and a pleasant matter. This was owing to the very excellent Treasurer they had. Mr. Gibb was a careful financier, who never brought up work in a half-finished state. They handled a very considerable sum of money in the twelve months. Their rental, for the year to May 15 last, amounted to £307,275, and their expenditure to £216,000; leaving a balance of £90,000. They paid all their indebtedness, with £800 over. He called that good finance. They had sinking and reserve funds amounting to £183,000. Their credit was good, and they could always get money on reasonable terms.

Provost MACKIE, of Leith, proposed the health of Mr. A. Wilson, the Gas Engineer of Glasgow. They were always pleased to have him with them, particularly when they remembered that, but for one vote, he might have been their Engineer.

Mr. WILSON regretted that his Convener—Mr. Calderwood—was not able, on account of indisposition, to be present. They were all very anxious to keep up the good relations which subsisted between Edinburgh and Glasgow. He regretted very much that Mr. Herring was indisposed, and he must take steps to express his sympathy with him. In the gas profession they recognized the great work that Mr. Herring had done for Edinburgh. Provost Mackie had said that he lost the appointment by one vote. He thought it a very good matter that that vote happened as it did, because it brought in another system of working in gas-works in Scotland, which they would not otherwise have had. It gave them competition in working which they could not have had if they had stuck to the horizontal retort system. Mr. Herring had made the inclined retort system a success, from which they were all in Edinburgh reaping a benefit; and they in Glasgow were also reaping a benefit, because it had spurred them on to greater exertions, to see that they could do as well with the horizontal system as could be done with the inclined. It was to the advantage of all consumers of gas that they should have this competition. He was very glad that in Glasgow he had had the opportunity to carry on things in the way that he thought best, and that Mr. Herring had had the opportunity in Edinburgh to carry on things in the way that he thought best. In the gas profession they recognized that the competition with electricity was a great benefit to them. In Glasgow this year they were going to have the biggest increase they had ever had, which meant that there was plenty of room for both systems of lighting. They were going to have an increase over last year in Glasgow of as much gas as would supply a town of the size of (say) Kilmarnock twice over. He begged to propose the health of the Lord Provost of Edinburgh, to whom, and to the Gas Commission of Edinburgh and Leith, of which he was Chairman, they wished all success.

The toast was acknowledged by the Lord Provost in a few words, and the proceedings were brought to a close by the singing of "Auld Lang Syne."

STREET LIGHTING BY GAS IN EAST LONDON.

At the Meeting of the Poplar Borough Council last Thursday, the Electricity Committee reported that an agreement had been submitted to them embodying the terms upon which the Commercial Gas Company would supply gas to public lamps. The inclusive rates of charge were as follows: No. 4 Kern burners, 70 to 100 candle power, £3 9s. per annum for the first eighteen months, and £2 18s. per annum thereafter; No. 3 Kern burners, 50 to 75 candle power, £3 9s. per annum for the first fifteen months, and £2 9s. per annum thereafter. The agreement was to be terminable by three months' notice after the expiration of the respective periods named in regard to the first installation of incandescent gas-lamps. The Committee recommended that the agreement should be sealed; and this was agreed to. On the same day, the Works Committee of the Bethnal Green Borough Council reported having had under consideration the question of improving the lighting of the main roads. For the past four months they have had on trial three types of double burners in some of the existing lamps in Bethnal Green Road and Hackney Road; and they gave in detail the results of the experiments and the inquiries made in connection therewith. In Bethnal Green Road, the lamps are fitted with double Sugg burners, which consume 5 cubic feet of gas per burner per hour, and cost for gas, lighting, extinguishing, and mantles, £5 12s. 4d. per lamp per annum. The lamps fitted with similar burners consuming 4¼ cubic feet of gas per burner per hour, cost for maintenance £4 19s. 7d. per annum. Other lamps fitted with "C" burners consuming 3⅜ cubic feet of gas per hour, cost for maintenance £4 17s. 4d. per annum, or £5 2s. 1d. if bye-passes are used. In Hackney Road, the various classes of lamps are in exactly the same order as in Bethnal Green Road. The Committee stated that if the Council decided to adopt double burners for lighting Bethnal Green Road, Green Street, Roman Road, Cambridge Road, and Hackney Road, except those portions which are partly lighted by Bethnal Green and partly by the neighbouring borough, the additional cost of the 5-feet burners over the existing lamps would be £380; if the 4¼-feet burners were used, it would be £292; and if "C" burners without bye-passes were used, it would be £276, or with bye-passes £309. The Committee were of

opinion that the best results were given by the 4½-feet burners. The cost of supplying the lanterns, fitted complete with double 4½-feet burners, would amount to about £2 18s. per annum. They proposed to erect these lamps in the roads specified; and in order to further improve and equalize the lighting, they suggested that nine additional lamps should be erected in the main roads—making a total of 138 lamps. The estimated cost of this work amounted approximately to £415 for the purchase of lanterns, &c., and the annual cost of maintenance, gas, &c., to about £691, or £292 in addition to the present annual cost. The Committee added that the cost of lighting per mile in Bethnal Green was £120 per annum; while the average in the 28 Metropolitan Boroughs was £178. The cost per mile in the neighbouring boroughs for the year 1903-4 (the last for which figures were available) was: Hackney, £157; Poplar, £222; Stepney, £233; and Shoreditch, £335. The Committee's suggestions were agreed to.

A RECORD YEAR FOR GAS AT TORQUAY.

In spite of competition, the prosperity of the Torquay Gas Company continues to grow in a very satisfactory manner. The report presented to the annual meeting last Wednesday announced that the increase in the sale of gas last year amounted to more than 8½ million cubic feet; and is a record in the history of the Company. A reduction in the price of gas last Lady Day from 2s. 11d. to 2s. 10d. per 1000 cubic feet no doubt had the effect of stimulating consumption; and this in turn reacted on the revenue. The receipts from the sale of gas increased by £533, and there was also a larger revenue from meters, prepayment fittings, and cooking-stoves on hire. Mr. W. B. Beynon (the Deputy-Chairman), who presided, congratulated the shareholders on these features of the report, and said the financial statement was distinctly encouraging for the future. The fact that the increase in the sale of gas constituted a record, could not be overlooked when they took into consideration the powerful opposition of the electric light supplied by the Corporation. The days of gas were clearly not yet numbered. The total revenue was £35,565, and the expenditure £27,915; leaving a balance of £7650. The receipts from residuals had increased by £996, and the revenue from this source was one of the main causes of the low price of gas. It was decided to pay the ordinary dividends of 10 and 7 per cent. on the two classes of shares. A letter was read from the Chairman of the Company (Mr. J. Kitson), who was unable to attend, calling attention to the advance in the price of coal, and pointing out that in view of this no further reduction in the price of gas could be thought of for the present. In the course of the discussion, reference was made by a shareholder to the question of forming a superannuation fund for the employees. The Chairman explained that the Directors found a difficulty in creating such a fund, because most of the workpeople and clerks subscribed to other funds, and were not prepared to pay to an additional one. No deserving old servant retired through ill-health or accident without receiving consideration from the Company. A recommendation was made by shareholders that the Directors should consider the question of a gratuity to the employees. Mr. R. Beynon (the Manager), Mr. R. P. Kitson (the Secretary), and Mr. J. Duckworth (the Accountant) replied to a vote of thanks passed to the officers of the Company.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Gas Commissioners of Edinburgh and Leith held on Monday last what is known as their statutory meeting, the business at which was exceedingly meagre, consisting only of the statement by Judge Bryson, the Convener of the Works Committee, that the Committee had that day fixed the price of gas for public lighting at 2s. 5d. per 1000 cubic feet for flat-flame burners, and 2s. for incandescent lighting—both figures being the same as last year. A more important gathering took place on Wednesday evening, when the Commissioners entertained themselves and a number of friends at dinner in the Royal Hotel. This was not a statutory meeting; but it was taken advantage of by speakers to make public a few facts regarding the gas undertaking—facts which are well known to those who interest themselves in such matters, but which the general public are in danger of forgetting unless they are occasionally reminded of them.* The evening was spent very pleasantly; the only subject of regret being the absence of Mr. W. R. Herring, the Engineer, who has fallen into ill-health, and had that day gone South to recuperate. As there will be numerous inquiries into the nature of his ailment, it may be as well to state that he is suffering from a carbuncle low down in the back of the neck, and to point out that the fact that he has been allowed to travel is an indication that his medical advisers are satisfied that he is on the way to recovery. There is but one wish regarding him in the district he serves, and that is that he may soon return to his duties, restored in health and re-invigorated in body by his holiday.

The Scottish Juniors from the Western District spent three very pleasant, and it is to be hoped profitable, hours in the oil-works of Messrs. James Ross and Co., at Philpstoun, three miles to the east of Linlithgow, this afternoon. Though it was oil and not gas works that were being visited, it was easy to be gathered that there was something to be seen which would be of value to gas makers. The presence of Mr. A. Wilson, of Glasgow, was sufficient to bear out this view. The chief point of interest was, of course, the vertical retorts. The inspection of these occupied most of the time. To anyone with even the slightest knowledge of carbonizing processes, the sight of the retort-bench at work must have been a great treat. The extreme simplicity of the arrangements and the quietness of the working must have struck many as being remarkable. But to those who have a more specialized knowledge, the explanations, which were very freely and fully given, of the principles underlying the working, could not have failed to bring home ideas that may be looked for to bear fruit. There was quite an education in itself in seeing the progressive nature of the carbonizing process as practised in the three distinct sections of the plant, each having been designed with a view to accomplishing something which experience had shown was not as yet being got, but which might be. About 800 tons of shale are put through in 24 hours. But for the activity displayed in the coal-breaking department, an outsider would not imagine that half of this quantity was being dealt with, so quiet and easy is the work. The Juniors may well be grateful to Messrs. Ross for giving them so excellent a lesson in carbonizing. An interesting

* A report of the proceedings will be found on p. 835.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 797.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Oct. 12	10½	Alliance & Dublin 10 p.c.	21—22	..	4 15 5
245,112	10	,,	7½	Do. 7 p.c.	14½—15½	..	4 16 9
200,000	5	Nov. 14	7	Bombay, Ltd.. . . .	6¾—7¼	..	4 16 7
40,000	5	,,	7	Do. New, £4 paid	5—5⅜	..	5 1 10
50,000	10	Feb. 28	14	Bourne-mouth Gas and Water 10 p.c. Pref.	27½—28½	+½	4 18 3
51,810	10	,,	7	Do. B 7 p.c.	16¾—17	..	4 2 4
53,200	10	,,	6	Do. 5 p.c. Pref.	14½—15½	..	3 17 5
380,000	Stk.	,,	12½	Brentford Consolidated	250—255	..	4 18 1
300,000	,,	,,	9½	Do. New . . .	190—195	..	4 17 5
50,000	,,	,,	5	Do. 5 p.c. Pref. .	117—122	..	4 2 0
206,250	,,	Dec. 13	4	Do. 4 p.c. Deb. .	101—104	..	3 16 11
220,000	Stk.	Mch. 14	11½	Brighton & Hove Orig.	220—225*	..	5 0 0
246,320	,,	,,	8½	Do. A. Ord. Stk. .	160—165*	..	5 0 0
460,000	20	Sept. 27	10	British	42½—43½	+½	4 11 11
104,000	Stk.	Feb. 28	6	Bromley, Ord. 5 p.c. .	119—122	+½	4 18 4
165,700	,,	,,	4½	Do. do. 3½ p.c. .	90—93	+½	4 16 9
500,000	10	Oct. 12	7	Buenos Ayres (New) Ltd.	11½—12	..	5 16 8
250,000	Stk.	Dec. 13	4	Do. 4 p.c. Deb. .	93—95	—1	4 4 3
150,000	20	Mch. 14	8½	Cagliari, Ltd.	23—25*	..	6 12 0
100,000	10	Sept. 27	10	Cape Town & Dis., Ltd.	14—15	..	6 13 4
100,000	10	Oct. 26	4½	Do. 4½ p.c Pref.. .	8½—9½	..	4 14 9
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	51—53	+1	5 13 2
50,000	Stk.	Dec. 28	4½	Do. 4½ p.c. Deb. Stk.	96—98	..	4 11 10
157,150	Stk.	Feb. 28	5	Chester 5 p.c. Ord. . .	109—111	..	4 10 1
1,443,280	Stk.	,,	5⅛	Commercial 4 p.c Stk. .	107—110	..	4 14 6
560,000	,,	,,	5	Do. 3½ p.c. do. .	105—108	..	4 12 7
475,000	,,	Dec. 13	3	Do. 3 p.c. Deb. Stk.	83—85	..	3 10 7
800,000	Stk.	,,	6¾	Continental Union, Ltd.	120—123	—1	5 5 8
200,000	,,	,,	7	Do. 7 p.c. Pref.	138—143	..	4 17 11
462,170	Stk.	Aug.	5½	Derby Con. Stk. . . .	122—124	..	4 8 9
55,000	,,	Jan.	4	Do. Deb. Stk. . . .	103—105	..	3 16 2
486,090	10	Jan. 31	11	European, Ltd. . . .	24—25	..	4 8 0
354,060	10	,,	11	Do. £7 10s. paid	18—19	..	4 6 10
15,203,110	Stk.	Feb. 14	4⅝	Gas-light and Coke 4 p.c. Ord. . .	95—97	..	4 10 10
2,600,000	,,	,,	3⅜	3½ p.c. max. . .	87—89	..	3 18 8
3,799,735	,,	,,	4	4 p.c. Con. Pref.	106—108	..	3 14 1
4,193,975	,,	Dec. 13	3	3 p.c. Con. Deb.	83—85	..	3 10 7
258,740	Stk.	Mch. 14	5	Hastings & St. L. 3½ p.c.	95—100*	..	5 0 0
82,500	,,	,,	6½	Do. do. 5 p.c.	116—119*	..	5 9 3
70,000	10	Oct. 12	11	Hongkong & China, Ltd.	19½—20½	..	5 7 4
4,940,000	Stk.	Nov. 14	8	Imperial Continental .	176—179	—2	4 9 5
473,600	Stk.	Feb. 14	3½	Do. 3½ p.c. Deb. Red.	93—95	..	3 13 8
184,601	Stk.	Mch. 14	6	Lea Bridge Ord. 5 p.c. .	117—122*	..	4 18 4
306,083	,,	Dec. 28	4	L'rpool Unit'd Deb. Stk.	110—112	..	3 11 5
561,000	Stk.	Feb. 28	10	Liverpool United A . .	223—225	..	4 8 11
718,100	,,	,,	7	Do. B. .	164—165	..	4 4 10
144,140	Stk.	Feb. 14	7⅞	Maidstone 5 p.c. . .	142—147	..	5 3 8
75,000	5	Nov. 29	5	Malta & Medn., Ltd. .	4¼—4⅝	..	5 5 3
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb..	101—103	..	4 17 1
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	101—103	..	4 7 5
541,920	20	Nov. 14	3½	Monte Video, Ltd. . .	11½—12½	..	5 12 0
1,775,892	Stk.	Feb. 28	4⅝	Newc'tle & G'tesh'd Con.	106—108	..	4 5 8
406,025	Stk.	Dec. 28	3½	Do. 3½ p.c. Deb.	96—97	..	3 12 2
15,000	10	Feb. 28	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
55,940	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	Nov. 29	8	Oriental, Ltd. . . .	150—155	..	5 3 3
60,000	5	Sept. 13	7	Ottoman, Ltd. . . .	5—6¼	..	5 7 8
398,490	5	Oct. 26	7	Primitiva Ord. . . .	7⅛—8	—¼	4 7 6
796,980	5	Jan. 31	5	Do. 5 p.c. Pref. .	5—5½	..	4 15 3
488,900	100	Dec. 1	4	Do. 4 p.c. Deb. .	95—97	..	4 2 6
851,070	10	Oct. 12	7	River Plate Ord. . .	12½—12⅝	..	5 7 8
300,000	Stk.	Dec. 28	4	Do. 4 p.c. Deb. .	95—97	..	4 2 6
250,000	10	Sept. 27	8	San Paulo, Ltd. . . .	13—13½	..	5 18 6
125,000	50	Jan. 2	5	Do. 5 p.c. Deb. .	48—50	..	5 0 0
135,000	Stk.	Mch. 14	10	Sheffield A	244—246*	+1	4 1 4
209,984	,,	,,	10	Do. B	244—246*	+1	4 1 4
523,500	,,	,,	10	Do. C	244—246*	+1	4 1 4
70,000	10	Oct. 26	10	South African	15½—16½	..	6 1 3
6,350,000	Stk.	Feb. 14	5½	South Met., 4 p.c. Ord.	120—123	..	4 9 5
1,895,445	,,	Jan. 16	3	Do. 3 p.c. Deb.	84—85	..	3 9 9
201,720	Stk	Mch. 14	8	South Shields Con. Stk.	154—156*	..	5 2 7
605,000	Stk.	Feb. 28	5½	S'th Suburb'n Ord. 5 p.c.	120—123	..	4 9 5
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	120—123	..	4 1 4
117,058	,,	Jan. 16	5	Do. 5 p.c. Deb. Stk.	125—130	..	3 16 11
502,310	Stk.	Nov. 14	5	Southampton Ord. . .	107—112	..	4 9 3
120,000	Stk.	Feb. 28	6½	Tottenham and Edmonton A 5 p.c. .	123—126	..	5 3 2
398,940	,,	,,	5	B 3½ p.c. .	101—103	..	4 17 1
137,500	,,	Dec. 28	4	4 p.c. Deb.	101—103	..	3 17 8
182,380	10	,,	8	Tuscan, Ltd.	10½—11	..	7 5 6
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	102—104	..	4 16 2
193,742	Stk.	Feb. 28	5	Tynemouth 5 p.c. max.	104—106	..	4 14 4
30,000	Stk.	Feb. 14	8	Wands-worth and Camberwell A 5 p.c. .	—	..	—
255,636	,,	,,	6½	B 3½ p.c. .	135—140	..	4 12 10
75,000	,,	,,	5⅝	C 3½ p.c. .	111—113	..	4 19 1
79,416	,,	Dec. 28	3	Putney 3 p.c. Deb. Stk	79—82	..	3 13 2
845,872	,,	Feb. 28	3½	West Ham 5 p.c. Ord. .	101—104	..	4 18 6
185,000	,,	,,	5	Do. 5 p.c. Pref. . .	120—123	..	4 1 4
228,300	,,	Dec. 28	4	Do. 4 p.c. Deb. Stk.	102—105	..	3 16 2

Prices marked * are "Ex div."

statement was made by Mr. J. W. Muir, the Works Manager, with reference to the shale-field. This extends northwards from the works; but after going a certain distance it was found that the shale became of a twisted and charred nature, and inferior in quality. This was owing to the fact that an eminence about a mile to the north is of volcanic origin, and the shale is understood to have been destroyed by the heat from the one time burning mountain. The firm, on discovering this, turned their workings eastwards, where they are finding shale in purity and abundance.

Mr. A. Wilson, the Gas Engineer to the Corporation of Glasgow, last night delivered the last of the series of popular lectures promoted by the Corporation on the work of the different departments. The lecture was given in the Berkeley Hall, and was well attended—Mr. Kirkpatrick presiding. Mr. Wilson informs me that there was nothing new in his lecture, and that he was, in fact, called in as a stop-gap; so that it is not necessary to say more than that Mr. Wilson's remarks and illustrations showing how to burn gas seemed to be regarded with much interest, as, there can be no doubt, he was able to give his hearers information which was altogether new to many of them.

In the Falkirk Town Council on Monday, the Gas Committee reported that the Manager had received estimates for the hooping of the chimney, which was showing signs of cracking, and that the tenders had been placed in the hands of the Convener and Manager, with powers. It was mentioned that a report upon the condition of the gas-works had been obtained from Mr. H. Rule, the Assistant-Manager, who acted as interim Manager; and that it was thought to be right, because it was desirable that they should know the condition of the works before the new Manager entered upon his duties. The proceedings of the Committee were approved of.

An inquiry was held in Glasgow on Wednesday, under the Private Legislation Procedure (Scotland) Act, 1899, into an application by the Caledonian Railway Company for a Provisional Order, in which they ask powers for various purposes. The only opposition to the measure was offered by the Dundee Town Council, who, as Gas Commissioners, had petitioned against the provisions relating to the carriage of coke from the gas-works to the harbour of Dundee. The Harbour Trustees had agreed with the promoters that, until after the expiration of seven years from November last, and the railway between Dundee and Arbroath had been widened by its increase to four lines of rails, the quantity of coke to be carried from the gas-works to the coal-hoist at the harbour should not exceed 100 tons per month, or 1000 tons per annum. The Commissioners asked that the minimum should be 250 tons per week, and that facilities should also be granted for the carriage of coal from the harbour to the gas-works. For the promoters, it was argued that to take coal and coke across the main railway line, at a point where there was a large quantity of traffic, would be dangerous; and that the remedy of the Town Council was to be obtained from the Railway and Canal Commissioners, if they thought that reasonable facilities were being denied them. For the Corporation, it was argued that the want of facilities for the carriage of coal and coke between the harbour and the gas-works put them to the disadvantage of having to pay more money to the Railway Companies (it is a joint line), which meant that the community must be charged an increased rate for gas. If it were difficult to take the material across the two main lines of railway, it would be infinitely more so to do it if there were four lines to cross. Mr. A. Yuill, the Gas Engineer to the Corporation, stated in evidence that the material carried by the Railway Companies last year into the gas-works was 74,410 tons, and out of the works 34,467 tons. The output of coke from the works was about 40,000 tons per annum, about half of which was sold in Dundee, and the other half either for shipment or sending inland. The total quantity sent out for shipment during the year to the 28th of February last was 8330 tons, made up as follows: 3926 tons to Methil, 3638 tons to Burntisland, 346 tons to Bo'ness, and 420 tons to Tayport. The railway dues paid for the conveyance of coke amounted to £1032. In consequence of the stand taken by the Railway Companies, they had been unable to get any coke shipped from Dundee, or to get any coal brought in by sea, except when, by an act of benevolence, the Companies allowed them to get a few waggons of coal from a ship's side into the works. The offer to accept 100 tons would be of no advantage to them; they would not be able to arrange for any ship to take so small a quantity. If they carted coal from the harbour, it would have to be put into waggons at the works, so that it might be carried to the high level. This view did not take into account the fact that they could get coal brought to Dundee cheaper by sea than by land. It cost 2s. 6d. per ton to carry coke from the gas-works to Fife ports, whereas 1s. per ton would be sufficient were the coke shipped from Dundee direct, which represented a saving of about £600 a year to the Commissioners. As late as the 14th inst., they had a good offer for 10,000 tons of coal, to be shipped for them at Grangemouth or Bo'ness; but they could not accept it, owing to being unable to convey it from the Dundee docks. Other evidence was to the effect that to carry 250 tons per week would require no more than four trains. The Parliamentary Commissioners who held the inquiry found the preamble of the Order proved, and repelled the objection of the Corporation. The decision is a disappointing one. What action they may now take has not yet been considered.

Notice was given in the Kilmarnock Town Council on Wednesday, by Mr. Turnbull, of a motion to the effect that a Special Committee should be appointed to consider and report on the present working of the Gas Department, as well as of the Electric Lighting and Tramways Department, with the view of ascertaining whether or not any schemes can be evolved with reference to either or all of them, whereby greater economy or efficiency can be obtained; the report to contain full particulars regarding the oncost of the working of each, and make special reference to the number of officials earning more than 30s. per week, with their salaries and duties, and be in the hands of the members of the Council not later than Saturday, the 8th of June next. A much smaller range of inquiry has occupied Special Committees for a far longer time than Mr. Turnbull seems willing to allow; but as his object may almost be read to be a day's shooting among officials earning more than 30s. per week, perhaps the inquiry may, if it should come to be made, be very much narrower than is threatened.

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Messrs. JOHN WRIGHT & CO. have just secured the renewal, for **ANOTHER** period of **THREE YEARS,** of the "Slot" **COOKER BUSINESS** of

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CURRENT SALES OF GAS PRODUCTS.

Week ending March 23.

There is little change in the London market for tar products. Ninety per cent. benzol is if anything a little firmer; and it is not thought that less than 11d. per gallon net would now be accepted. Toluol, both 90 per cent. and pure, is in very good demand. Considerable sales of 60° crude carbolic have been made at 1s. 8½d. Crystals continue at about 5⅝d. net for 35°. There is more inquiry for ordinary London creosote than can really be satisfied; and it is not expected that 2¼d. net at makers' works would now be accepted. Inquiries for pitch, both for prompt and to the end of this year and well into next year, are increasing; and makers' ideas continue to be very firm—27s. to 28s. net at makers' works is a fair quotation for next season. Sulphate of ammonia continues quiet; but the price is maintained at about £12 per ton on Beckton terms.

LIVERPOOL, *March* 23.

Sulphate of Ammonia.

There has again been a quiet market, available parcels being more plentiful, while fresh orders have been rather scarce. The large makes are being delivered and shipped against contracts made in advance. So far Home demand has only been on a moderate scale. Consequently the closing quotations are £11 15s. per ton f.o.b. Hull, £11 17s.6d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. Neither has there been any activity for delivery ahead, buyers not being seriously in the field. For April-June and April-September delivery, £12 per ton is quoted; but although £12 is reported to have been paid, business has been done at something less.

Nitrate of Soda.

This article is firm both on spot and for spring arrival; and spot prices remain 11s. 6d. and 12s. per cwt. for 95 per cent. and refined quality respectively.

LONDON, *March* 23.

Tar Products.

Markets have been very quiet during the past week. In pitch, there again appears to be some disposition on the part of manufacturers to sell for delivery this side of June. In London, business has been done at 25s. 6d. for prompt; while on the east coast 25s. has been accepted. At ordinary ports on the west coast 24s. has been taken, and 24s. 6d. in Liverpool. There is little demand on the Continent, where buyers are only interested in forward delivery, and that at very low prices. Benzol, 90 per cent., is very quiet. Business has been done freely on the east coast at 10d.; and it is reported that in one instance 9¾d. was accepted. Although steady, 50-90 per cent. is quiet, and makers would accept 11d. on the east coast. Toluol is very firm and scarce; but there is no alteration in price. Solvent naphtha is slightly steadier; and it is reported that 1s. 2d. has been realized at a favourable port on the east coast. The second-hand parcels of creosote which have lately depressed the London market have now been cleared away; and as the London makers are well sold and quite content to wait, the market is very firm indeed, and high prices are asked. In the North, business is again reported at 2d.; but most of the manufacturers are asking 2⅛d. In the Midlands, oil is exceedingly scarce, and from 2⅜d. to 2½d. per gallon is being paid. In carbolic acid, Continental consumers have now reduced their price to 1s. 8d. per gallon on the east coast, and consequently English buyers have also reduced their limits. Crystals are unchanged, with orders very scarce indeed; and manufacturers would certainly accept something under the market prices for a good contract. There is no alteration in the position of anthracene.

The average values during the week were: Tar, 14s. to 18s. Pitch, London, 25s. 6d. to 26s.; east coast, 25s.; west coast, 24s. to 24s. 6d. Benzol, 90 per cent., 10d. to 10½d.; 50-90 per cent., 11d. to 11½d. Toluol, 1s. 2d. to 1s. 2½d. Crude naphtha, 4¾d. to 5d.; solvent naphtha, 1s. 1½d. to 1s. 3d.; heavy naphtha, 1s. 2d. to 1s. 4d. Creosote, London, 2½d. North, 2d. to 2½d. Heavy oils, 2⅜d. to 2⅝d. Carbolic acid, 60 per cent., 1s. 8d. to 1s. 8½d. Naphthalene, £5 to £9; salts, 37s. 6d. to 42s. 6d. Anthracene, "A" quality, 1½d. to 1⅝d.

Sulphate of Ammonia.

The market is very quiet indeed, and prices appear to be declining. In London, the principal Companies now ask £12 1s. 3d.; but ordinary makes could be secured at considerably under this figure. In Leith, £12 is again reported to have been paid; but doubtless the very small quantity offering is the explanation of such a good figure having been realized. In Liverpool, £11 16s. 3d. has been accepted for second-hand lots; but, on the other hand, makers report having refused offers of £11 17s. 6d. In Hull, small quantities have been sold at prices varying between £11 15s. and £11 17s. 6d.

Gas Exhibition in Kilmarnock.—Last week an exhibition of the gas appliances of Messrs. R. & A. Main, Limited, and of Messrs. Falk, Stadelmann, and Co., Limited, was held in the Oddfellows' Hall, Kilmarnock, under the auspices of the Corporation of that town. At the opening ceremony, Provost Hood pointed out the advantages, in the matter of cleanliness, convenience, and economy, which were to be gained by using gas appliances. Mr. A. P. Main spoke of the rapid development that had taken place in the use of gas-stoves, and said it was always a pleasure to come to Kilmarnock, for in Mr. Fairweather the Corporation had one of the most enterprising gas engineers in the country, and one who gave every facility to the public to acquire stoves for all kinds of work. Miss E. M. Dods lectured twice daily.

Gas Plant and all constructional Steel and Iron Work.

Specialists in Slot Meters, Ordinary Meters, Wet & Dry.

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COAL TRADE REPORTS.

Lancashire Coal Trade.

The request for steam coal continues in such considerable volume from many quarters that the commodity is kept scarce; and while that condition is maintained, there is no likelihood of prices falling. Although it is true that house coal has decreased in demand, it is still large enough to compel some coalowners to draw supplies from stocks. There are no reductions in rates. Steam coal and cannel, as pointed out last week, are considerably dearer. Users, however, come to the terms as they find them. Contracts are readily entered into. The shipping trade in coal remains steady. Some curiosity has been aroused by the puffing of some new invention in the treatment of coal which is said to be about to be established in Trafford Park, and which, according to Sir Wm. Bailey, is shortly to astonish mankind; but the stolidity of John Bull has not been much moved by the announcement. He will require actual proof of the efficacy of the invention before giving any credit to the at present hidden marvel. Last week's quotations, as averages, remain unchanged; but while there is little coal of any description to be had at less than our quotations, the better qualities in many of the Lancashire pits are realizing higher figures. The past year has been exceptionally prosperous in the coal trade. The total output was 236,111,150 tons, or an increase of 15,000,000 tons compared with 1905. Coal exported to foreign countries last year was 57,792,000 tons, to which must be added 17,396,000 tons of bunker coal, making the gross exports 76,382,000 tons. From the Great Central Railway Company's docks at Grimsby, the exports in 1874 were 366,000 tons; in 1885 there were 409,000 tons; in 1895 the total was 1,124,000 tons; in 1905 the total rose to 2,161,000 tons; and in 1906 to 2,522,000 tons.

Northern Coal Trade.

There is a better request for coals; but it has been interfered with by the stormy weather, which delayed the arrivals of collier-steamers. The pits have, on the whole, worked well; and there is a demand now that is made heavier by the usual needs before the holiday. In the steam coal trade, best Northumbrian steams are about 15s. per ton f.o.b., second-class steams are 13s. to 13s. 6d., and steam smalls are firm at 8s. 6d.—the approach of the Baltic season rather stimulating the market. In the gas coal trade the question of the renewal of the long southern contracts has come to the front. The general inquiry for Durham gas coals shows some falling off, as is usual near the end of March; but the deliveries are well taken up. The price that is current is from 11s. 10d. to 12s. 9d. per ton, according to quality, f.o.b.; while an occasional sale at slightly less may have been made, where a colliery was feeling the effect of the delay of steamers. As to the contracts, the news of the placing of large quantities in Yorkshire does not seem to have much influenced prices here. Coke is steadier, with a better demand for furnace kinds. Gas coke is firm—the price for good gas coke varying from about 13s. 6d. to 14s. 6d. per ton f.o.b.

Scotch Coal Trade.

There is no change in the market; but there is a change in the situation, in respect that on Friday last the Scottish Coal Trade Conciliation Board agreed to advance the miners' wages by 6¼ per cent.—equal to 3d. per day. This is already the third increase of a similar amount this year; and there are now indications that a rise in the wages of the oncost men is to be asked. These constant advances in wages do not give much promise of an early reduction in the price of coal. Meantime, there is a great demand for all sorts of coal; and prices are not quotably higher. These are given at: Ell 12s. to 13s. 6d. per ton f.o.b. Glasgow; splint 13s. to 13s. 3d., and steam 11s. 9d. to 12s. The shipments for the week amounted to 249,987 tons—a decrease of 14,016 tons upon the preceding week, but an increase of 29,257 tons upon the same week of last year. For the year to date, the total shipments have been 2,601,504 tons—an increase of 165,164 tons upon the corresponding period of 1906.

Yorkshire Gas Coals for London.

Under the above heading, the "Newcastle Journal" last Tuesday made the following remarks: "We understand that the negotiations which have been in progress on the part of the large London Gas Companies with the Yorkshire collieries have now resulted in very considerable purchases, amounting in all, it is said, to about 1,000,000 tons out of a total 3,500,000 or more required. This 1,000,000 tons is said to be apportioned to the two chief London Companies in the proportion of 600,000 and 400,000 tons each; while the prices range round about 10s. 9d. to 10s. 10½d. a ton f.o.b. Humber—that portion bought c.i.f. being reported at 13s. 9d. to 14s. a ton, with a freight calculated to be about 3s. 1½d. a ton. So far neither of the Companies indicated appears to have bought anything in this district; but it is currently reported to-day that the tenders sent in to the Commercial Gas Company on the basis of current prices have been rejected as out of the question, while the collieries in reply have simply declined further negotiations, and something like a deadlock between buyers and sellers has arisen in consequence.

Embezzlement by a Meter Inspector.—A fine of 20s. and costs was the light punishment imposed (consequent on the prosecutors declaring that they had no desire to press the case), at the Keighley West Riding Police Court, upon Harry Firth, late a gas-meter inspector in the employ of the Haworth Urban District Council, whose money he was charged with embezzling. Only two sums, amounting to about a sovereign in all, were mentioned in the charge. Evidence was given by a man who used to go round and take the meter-indices with defendant, that the latter called out the readings while the witness entered them up; and the allegation was that in one of the two cases defendant had so manipulated his index-book as to make the amount of gas consumed correspond with the money he had handed over to the collector. In the second case, however, there was no entry whatever for gas for the half year for which he had received payment.

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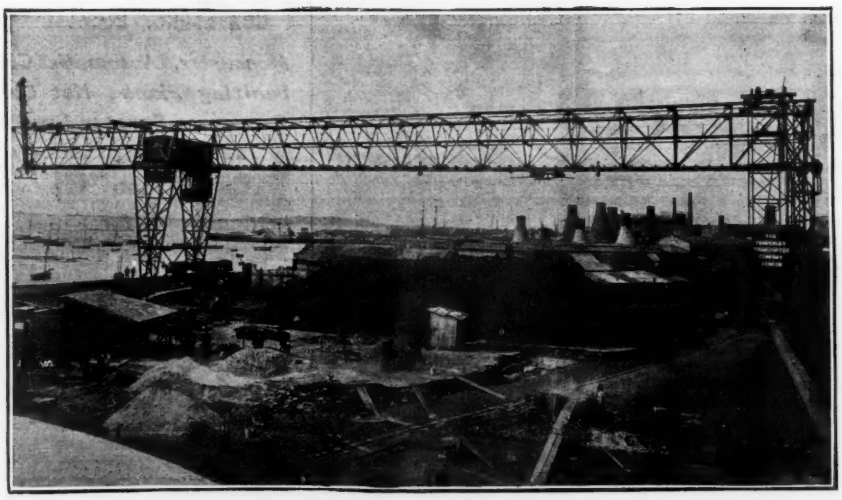

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Sales of Shares and Stock.

At the Mart, Tokenhouse Yard, last Tuesday, Mr. Alfred Richards placed two new issues of capital by order of Directors, and conducted a successful sale of shares and stock. The first new issue consisted of some £10 "G" ordinary and preference shares in the Aldershot Gas and Water Company. The former rank for a maximum dividend of 7 per cent., and are entitled to a dividend at this rate; and they were all sold at from £14 to £14 2s. 6d. per share. The preference shares were 5 per cent., and they fetched from £11 12s. 6d. to £12 each. The other new issue was £3000 of additional ordinary stock and £2500 of 5 per cent. preference stock of the Southgate and District Gas Company. The ordinary stock was sold at from £140 to £141 per £100 of stock, *cum div.* at the rate of 7 per cent. per annum as from the 1st prox. The preference stock realized prices ranging from £110 to £114 per £100. Some original ordinary consolidated stock of the Brighton and Hove General Gas Company, ranking for a standard dividend of 10 per cent., subject to the sliding-scale, and carrying 11½ per cent., was sold at from £220 to £222 10s. per £100; and some "A" ordinary consolidated (7 per cent.) at from £160 to £162 per £100, *cum div.* at the rate of 8¼ per cent. per annum. A parcel of fully-paid £10 "B" shares in the Tendring Hundred Water Company (last dividend 4½ per cent. per annum) was disposed of at from par to 5s. prem. It may be remembered that tenders were recently invited in our advertisement columns for an issue of £15,851 of consolidated stock of the Newport (Mon.) Gas Company, bearing a maximum dividend of 5 per cent. per annum. They were opened on Friday, when it was found that the applications were for much more than the amount at disposal. The issue was allotted at prices ranging from £114 down to £111 per £100 of stock; but a proportion of the tenders at the lower price had to be declined.

Belfast and the Lighting of Whiteabbey.

In the "JOURNAL" last December (p. 771), reference was made to a proposal of the Belfast Rural District Council to secure the powers of an Urban Sanitary Authority, under the Public Health (Ireland) Act, 1878, for the purpose of the public lighting of Whiteabbey and part of Jordanstown. An inquiry was held by the Local Government Board; and as the result of the report of the Inspector (Dr. C. J. Clibborn), they have written informing the Belfast Rural Council that, in their opinion, the necessity for the lighting has been generally established, and the opposition which was offered at the inquiry was mainly confined to the question of the extent of the area of charge. The Board, however, do not consider it necessary to deal with this point at the present stage, in view of an objection raised by Mr. D. M. Wilson on behalf of Major-General M'Calmont. The effect of Mr. Wilson's contention was that the grant of urban powers would not enable the Rural District Council to do what they proposed—namely, to purchase the gas at a fixed rate from the Belfast Corporation, and convey it to the lighting area at Whiteabbey—inasmuch as the power of contracting for a supply of gas conferred on an urban authority by section 80 of the Public Health (Ireland) Act, 1878, is limited to contracts with a company or person supplying gas within the district, whereas the Belfast Corporation do not appear to supply gas in any portion of the rural district. The Board are advised that this objection is well founded; and, accordingly, before taking any further action in the matter, they desire to give the rural district an opportunity of reconsidering their position. They add that the powers given under the second section of clause 80, if conferred on the Council, would enable them to undertake to supply gas themselves; but they would probably find it desirable to obtain a Provisional Order for the purpose, so that they might be possessed of the powers given by the general statutes for gas-works. It has been decided to hold a special meeting of the Rural District Council to consider the letter.

Reinstating Trenches in Westminster.

In a report circulated last Tuesday, the Works Committee of the Westminster City Council stated that they had had under consideration a letter from the Gaslight and Coke Company with reference to the Council's charges for reinstating trenches in macadam roads. In the opinion of the Company, the Council's specification for such work is too onerous to allow of a reasonable quotation being forthcoming. The Company referred particularly to the use of a steam-roller on all trenches and the minimum charge at the rate of 2 yards, and went on to suggest that the use of the roller should be limited to openings for mains only of a minimum superficial area of 23 feet, and that the minimum charge should be fixed at 1 yard instead of 2 yards. From inquiries made by the Committee in other Metropolitan Boroughs, it seemed that in seven of them the steam-roller is used on all trenches without distinction, in fourteen it is used on large trenches only, not including services, and in two it is not used at all. The average price per square yard charged by 22 of the Boroughs is 2s. 2½d., while the Westminster Council's present charges are 3s. 6d. per square yard under 5 yards, and 3s. per square yard over 5 yards. Where a minimum charge is fixed in other boroughs, it is at the rate of 1 yard. In Westminster the Council's minimum is 2 yards. On receipt of these replies, the Committee adjourned the consideration of the Company's letter, in order to enable the City Engineer (Mr. J. W. Bradley, M.Inst.C.E.) to amend the specification attached to the Council's tender form for reinstating macadam roads after trenches had been made. The City Engineer has now submitted his revised specification, which retains the condition that all trenches shall be steam-rolled, but the price to be inserted in the schedule is to be for "repairs to trenches at per yard super., whatever the length or area of the trench may be," instead of prices for more than 5 yards, for less than 5 yards, and for a minimum charge included in the existing contract. The Committee have directed that tenders should be invited for repairs to trenches in macadam carriageways to the revised specification and schedule submitted by the City Engineer; and the Gaslight and Coke Company are to be informed of the action taken.

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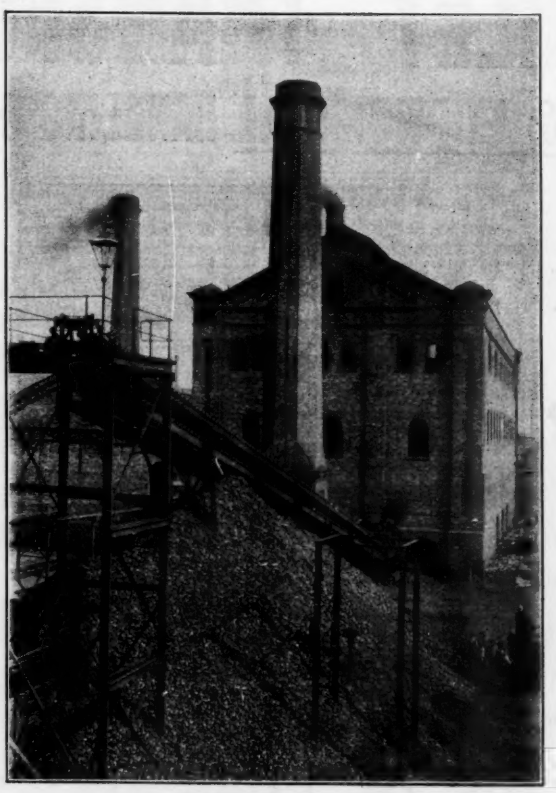

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Reduction in Price at Exmouth.—The Directors of the Exmouth Gas Company have made a reduction of 1d. per 1000 cubic feet in the price of gas; bringing it down to 3s. 5d. A discount of 5 per cent. being allowed, the net price is 3s. 3d.

Cost of Street Lighting in Southwark.—At the meeting of the Southwark Borough Council last Wednesday, the Works Committee submitted the following return (prepared by the Borough Engineer) of the cost of street lighting in various parts of the district: High-pressure gas in Borough High Street, £1129 6s. 8d. per mile; electric arc lamps in Walworth Road, £865 6s. 8d.; incandescent gas in the Borough High Street, £308; do. in Old Kent Road, £242; electric Nernst lamps in Falmouth Road, £242; do. in Gurney Street, £130 3s. 4d.; incandescent gas in Swan Street, £168 13s. 4d.; Searles Road, £154; Heygate Street, £113 13s. 4d.; Pollock Road, £95 6s. 8d.

A Gas and Electric Competition at Wolverhampton.—Considerable anxiety was lately displayed by both the Wolverhampton Corporation Electricity Department and the Wolverhampton Gas Company to secure an extensive lighting contract at the Sunbeam Motor Works at Blakenhall; and in order that a decision might be arrived at regarding the claims of the rival illuminants on the score of economy, a lighting competition was held in the show-room at the works. Two 500-candle power electric arc lamps and two 300-candle power incandescent gas-lamps were left burning for 60 hours. The cost, it is said, worked out at 14s. 9d. for the electric light, against 4s. for gas. It will be seen therefore that, even after making allowance for the difference in the nominal candle power of the lamps, the result was enormously in favour of gas. The contract has been given to the Gas Company.

Gas Supply at Blackwater.—At the recent annual meeting of the Blackwater Gas Company, the Directors reported a balance of profit which would allow of the payment of the maximum dividends at the rate of 10 and 7 per cent. The Chairman (Mr. A. H. Claypole, J.P.), in moving the adoption of the report, said the make of gas last year had been 50 million cubic feet, or at the rate of 10,500 cubic feet per ton of coal used. All the items on the receipts side of the revenue account showed increases, while, with the exception of coal, those on the expenditure side exhibited decreases; and on the total amount there was, notwithstanding a 10 per cent. augmented make of gas, a reduction of 6 per cent. in the working expenses. He gave the following figures to show the growth of the Company: In 1900 the make of gas was 16,666,800 cubic feet; in 1901, 18,674,300 cubic feet; in 1902, 21,120,700 cubic feet; in 1903, 32,304,000 cubic feet; in 1904, 42,523,200 cubic feet; in 1905, 45,428,500 cubic feet; and last year 50,566,400 cubic feet. He said these figures needed no comment; and he would only add that this year, up to the present, there had been an increase of 1,373,600 cubic feet in the make, compared with last year. Mr. A. Kitt remarked that the growth of the Company's business had been unprecedented. The report was adopted, and the dividends recommended were declared. A vote of thanks accorded to the officers was acknowledged by the Secretary (Mr. S. Rowe) and the Engineer (Mr. J. Meiklejohn).

Price of Gas at Wrexham.—In last week's "JOURNAL" (p. 767), when referring to the report of the Directors of the Wrexham Gas Company, it was stated that they "proposed" to reduce the price of gas by 3d. per 1000 cubic feet, to take effect in the September quarter, which would make the net charge 2s. 3d. for lighting, and 2s. for cooking. This was, however, a mistake, as the reference in the report was to a reduction of 3d. which was made last September, by which the net prices became as follows: For lighting, 2s. 6d.; for cooking, 2s. 3d.; and for engines, 2s. per 1000 cubic feet.

Proposed Retort-House Machinery for Skipton.—When submitting to the Skipton Urban District Council a scheme for the introduction of stoking machinery to the gas-works, Mr. W. Graham, the Chairman of the Gas Committee, said he regretted that the inevitable result would be to displace labour; but he pointed out that, on humanitarian grounds alone, the change was justifiable, inasmuch as human stoking was a burden which should not be imposed upon any man. The estimated cost of the change was £2535; and the saving effected in working would be at the least £500 a year. There was a long discussion, during which opposition was raised, on the grounds that the time was inopportune, having regard to several public schemes now being carried out, and that the change would involve serious structural outlay at the works. It was eventually decided to postpone coming to a decision on the matter.

Wakefield Water Supply.—In his report for the past year, the Wakefield Water Engineer, Mr. C. Clemesha Smith, says that the daily average consumption of water in the city and out-districts was 2,599,000 gallons, an increase of 28,700 gallons over that of the previous year. Meter supplies increased by 110,900 gallons daily; but the domestic supply (all unmetered) decreased by 82,200 gallons per day. The number of persons supplied outside the city is approximately 100,000. The out-districts consumed 460,746,000 gallons, showing a net increase on the previous year of 14,822,000 gallons. The city's consumption was: By meter, 185,454,000 gallons, or an increase of 24,084,000 gallons; otherwise than by meter, 262,268,000 gallons, or a decrease of 29,961,000 gallons. The total consumption was 948,648,000 gallons, showing a net increase on the year of 10,499,000 gallons. The Deacon meter system continued to work to advantage.

Messrs. Joseph Taylor and Co., of Bolton, have received from Messrs. Kempson and Co., Limited, of Pye Bridge, an order for one of their latest type of solid plate-lead saturators, for a make of 25 tons per week. The last one has been at work for over sixteen years.

The Conway Rural District Council have written stating that, should the Llandudno Urban District Council proceed to obtain powers for supplying the village of Penrhynside with gas, the Rural Council would offer no objection to such procedure. The Llandudno Gas Committee recommend that the Clerk should take steps to secure the necessary powers.

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Messrs. W. Speaight and Sons, of Fetter Lane, E.C., have published (price 1d.) "A Simple Explanation of the Workmen's Compensation Act, 1906," for the use of employer and employee.

The Pinner Gas Company, in answer to their recently advertised invitation for tenders for 400 (B) shares of £5 each, received tenders for over 600 shares. The average price at which the shares were allotted was a fraction under £7 9s. per share.

We have received from the Carron Company their new abridged catalogue of general castings, which has just been issued. They occupy about 60 quarto pages, and yet they are stated to be only a small selection from the Company's immense range of manufactures. The Company have special facilities for the production of iron goods, as they mine their own ore, smelt it with coal from their own collieries, and carry out all subsequent operations at their works at Carron, in Stirlingshire; and the catalogue under notice will give an idea of the varied character of the articles turned out.

Messrs. J. & H. Robus, the well-known Engineering Contractors, announce the removal of their London Offices from Bucklersbury to Nos. 2 and 3, Norfolk Street, Strand, W.C.

We have received from Messrs. Peckett and Sons, of the Atlas Works, Bristol, a very artistically got-up booklet containing views of their shops and some of the locomotives built therein. The productions of the firm are exclusively confined to locomotives for branch lines, for shunting and hauling operations at gas and other works, as well as for contractors' purposes; and a special feature is that all parts are made to standard gauges and templates, so that every locomotive is interchangeable with others of the same size and class. The views of the works, which cover five acres, occupy 42 oblong pages; and they are followed by about a score of examples of locomotives. The illustrations, which are preceded by some introductory remarks, are very clearly printed, and are enclosed in a stiff embossed wrapper bearing an effective design.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

GAS AND WATER ENGINEER. Ramsgate Corporation. Applications by April 15.
COAL REPRESENTATIVES. No. 4736.
CHEMIST AND DRAUGHTSMAN. York Gaslight Company. Applications by April 2.
CHARGE OF SMALL WORKS. No. 4747.
CANVASSERS (GAS STOVE). No. 4749.
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Situations Wanted.

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METERS. Belfast Gas Department. Tenders by April 4.

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REDHILL GAS COMPANY. April 9.
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WEST HAM GAS COMPANY. April 9.

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BANGOR (N.W.) GAS DEPARTMENT. Tenders by April 16.
CHORLEY GAS DEPARTMENT. Tenders by April 3.
DUNDEE GAS DEPARTMENT. Tenders by April 1.
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NEWPORT (FIFE) GAS DEPARTMENT. Tenders by April 2.

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No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EASTER HOLIDAYS.

In consequence of the EASTER HOLIDAY, all Communications for the next issue of the "JOURNAL" and Orders respecting ADVERTISEMENTS should be received at the Office NOT LATER than the FIRST POST ON SATURDAY.

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